T H E U N I V E R S I T Y O F M I C H I G A N

COLLEGE OF ENGINEERING
Department of Meteorology and Oceanography

Technical Report

OBSERVED LAND AND LAKE BREEZE CIRCULATION ON THE EASTERN SHORE OF LAKE MICHIGAN, 25 JUNE, 1965

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ORA Project 08650

Supported by:

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
PUBLIC HEALTH SERVICE
DIVISION OF AIR POLLUTION
GRANT NO. AP 00380-01,02,03
WASHINGTON, D. C.

administered through:

OFFICE OF RESEARCH ADMINISTRATION ANN ARBOR

October 1968

A C K N O W L E D G E M E N T S

The authors wish to express their sincere appreciation of the work of several persons in the execution of this study. In particular Prof. G C. Gill for his assistance in selection of instruments and Messrs. F Brock and A. Stohrer for their work in the field and in the data processing. The tower and instrument shelter location at the shore of Lake Michigan provided by the Water Department of the City of Grand Rapids, Michigan constituted an ideal lakeshore observation site. The generosity of this department is gratefully acknowledged. Thanks is also given to Mr. D Haig, the captain of the R/V MYSIS for his excellent assistance in the observational program on Lake Michigan.

The writers also gratefully acknowledge the work done by Mrs. Anna L. DeRey, Mrs. Karen Tingle and Mr. Dirk Herkhof in abstracting and preparing the data. Thanks is also given to Mrs. Bonnie Nuttall and Mrs. Ruthie Tolbert for typing the many tables and the original manuscript and to Dr. Valentin Vitols for reading the manuscript and making useful suggestions.

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ABSTRACT

An observational study carried out near Grand Haven, Michigan on 25 June, 1965 has produced probably the most extensive measurements available of a nearly idealized land and lake breeze circulation. The complete cycle of nocturnal land breeze to lake breeze during the day with a return to land breeze at night was observed and measured. These data constitute field measurements that are available for the guidance of theoretical studies and for the experimental evaluation of proposed lake breeze models.

The synoptic situation is documented and several mesoscale analyses presented. Several graphs describing winds and temperatures as functions of time and space are included as is a graph indicating moisture change at various stations. The penetration of the lake breeze front is measured by wind, temperature, and moisture changes. Temperature lapse rates, wind profiles, and their variations are presented.

A comprehensive summary of previously reported observational studies of land, lake, and sea breeze circulations is reported.

1. INTRODUCTION

The effects of mesoscale meteorological phenomenon on large scale circulation, local climate, air pollution dispersion, etc., have received increased attention in recent years. The air-sea interactions and the effects of the land-water transition on energy transfers in the atmospheric boundary layer and on mesoscale circulations are just beginning to be understood. Since 1963 the Department of Meteorology and Oceanography at the University of Michigan has been conducting observational studies of the mesoscale wind circulation and related temperature and moisture structure near the southern basin of Lake Michigan. Intensified studies have been conducted mainly during spring and early summer, when the daytime temperature difference between land and water is at a maximum and well defined lake breeze circulations occur. One particularly well documented lake breeze, which occurred on the eastern shore of Lake Michigan on 25 June, 1965, is presented in this report. A summary of these observations has been presented by Olsson, Cole and Hewson (1968).

Munn and Richards (1964) have used climatological records to show lake breeze

occurrences at a location near Lake Huron. They have also described typical lake breeze circulation features. Moroz (1965, 1967), using observational methods similar to those presented in this report, has described a lake breeze on the eastern shore of Lake Michigan. The main difference between his description and the one presented here is the resolution of data in time and space. While Moroz had to synthesize "a lake breeze day" from observations taken on days with similar synoptic situations this report documents one day with the nocturnal land breeze reversed to a daytime lake breeze and the return to a land breeze in the evening. Strong (1968) and Strong and Bellaire (1967) have observed and discussed lake effects and lake breezes over and near Lake Michigan. Hewson and Olsson (1967) have summarized various lake effects and their influence on air pollution dispersion.

Estoque (1961) has produced a two dimensional numerical model for the sea breeze into which he later imposed a gradient wind (1962) and McPherson (1968) has expanded this model into three dimensions. Moroz (1965) has developed a two dimensional numerical model for the lake breeze under zero gradient wind conditions. Strong (1968) has

shown that with a gradient wind of more than 5 m sec^{-1} a Great Lake is of sufficient size to be modeled as an ocean and Estoque's numerical model becomes "valid" also for the lake. Upper air soundings and surface weather information from stations surrounding the Great Lakes indicate that the gradient winds for 25 June, 1965 were in general less than 5 m sec^{-1}.

While several authors have contributed to the knowledge and understanding of sea, lake, and land breezes, only a few have undertaken to observe the development of those circulations in space and time. Besides the observations of lake breezes mentioned above, Fisher (1960), Frizzola and Fisher (1963), and Angell and Pack (1965) have reported on recent sea breeze observations at middle latitudes. Sea breezes in the tropics have been observed and described by van Bemmelen (1922), and Dixit and Nicholson (1964). Wexler (1946) and Defant (1951) have summarized the main features of land and sea breezes and Fujita (1965) has published a bibliography including most lake and sea breeze studies. A summary of the findings made in these earlier observational studies will be made later in this report.

2. LOCATION OF STUDY AND OBSERVATIONAL PROGRAM

Observations were made at a site on the eastern shore of Lake Michigan near Grand Haven, Michigan. The relative location of the site and the observational stations of primary concern are indicated in Figure 1. The coordinate system used throughout this report is such that the x-axis coincides with "the observation line" along Michigan highway 45 (M-45) and is positive to the east, the y-axis coincides with the coast south of origin (the intersection of M-45 and shore line) and is positive to the north. The altitude of the ground surface is everywhere set to be zero and the z-axis is positive upward.

The site selected offers several distinct advantages. The lake is long and narrow (approximately 110 km wide) with its axis running nearly north-south, the curvature of the shoreline is small and does not strongly modify the flow patterns and along shore homogenity can for all practical purposes be assumed in the neighborhood of the observation line. Sand dunes run parallel to the sand beach, with heights of up to 50 meters above mean lake level. The dunes are in general confined to within 1 km from the shore, and

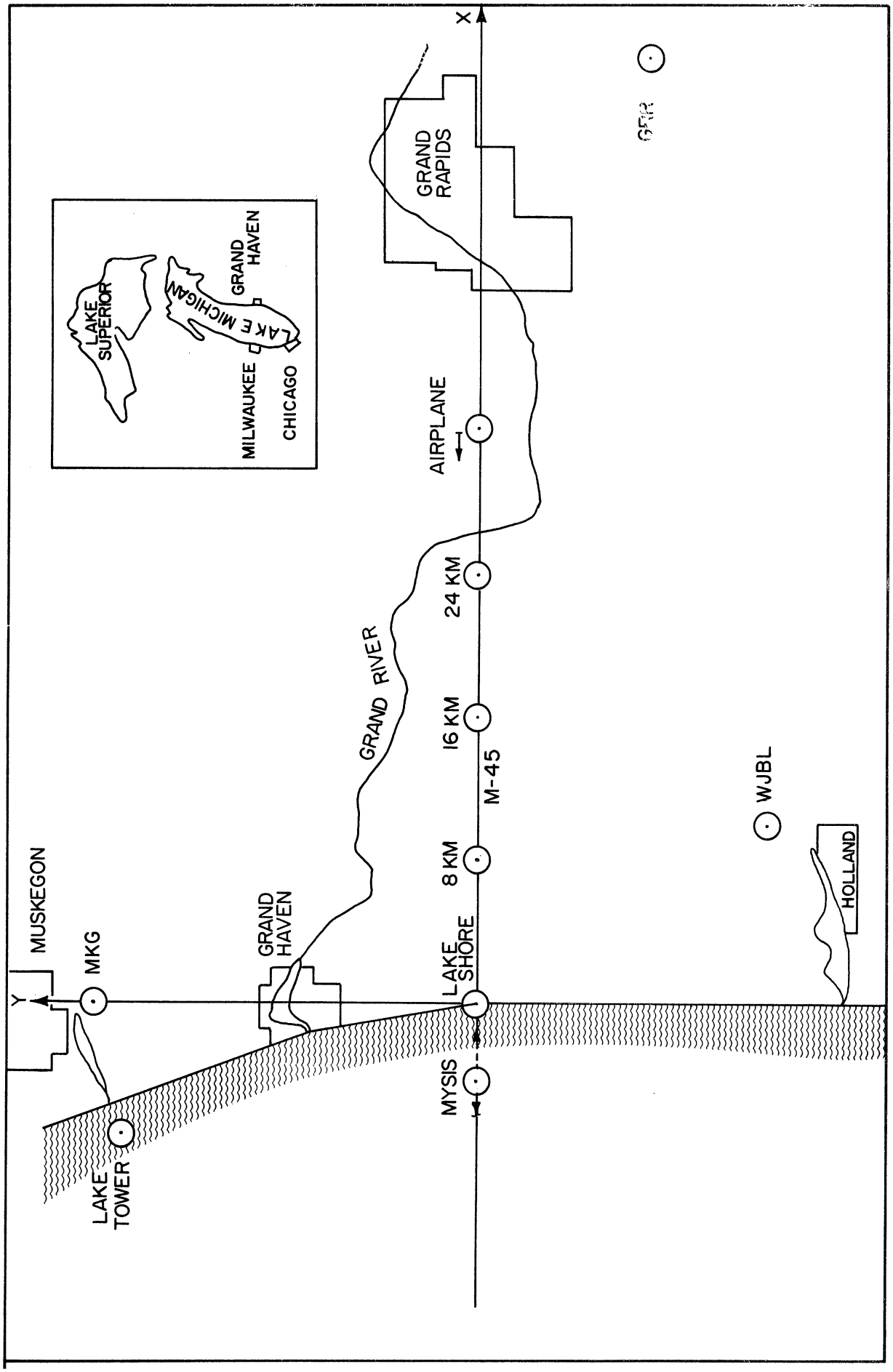

FIGURE 1. Location of observation stations on the eastern shore of Lake Michigan. Insert shows the location of the line of observations relative to Lake Michigan.

are partly covered with trees. Two or three km inland from the lake the land becomes flat and is uniformly developed for agriculture. The slope of the land from Grand Rapids toward the lake shore is small (approximately 1/1000) and it is assumed that no slope winds develop.

A short description of the stations and their instrumentation follows:

Lake shore station (0 km) was located on the lawn at the Grand Rapids pumping station, in a 200 m wide break in the sand dune chain. A USWB-type instrument shelter was located on a lawn 50 m from shore, 15 m above mean lake water level, and 20 m lakeward (west) of the 10 m high pumping station, Figure 2. Temperature and relative humidity were recorded on a Bendix Friez Model 594 recording hygrothermograph in the shelter. Due to a failure in the recording device, no surface winds were obtained for 25 June. The winds used as representative for this station are averaged from observations obtained from nearby U.S. Coast guard stations. Winds aloft were measured by either single or double theodolite tracking of pilot balloons. Figure 3 shows a theodolite crew at work at the lake shore station. The theodolites

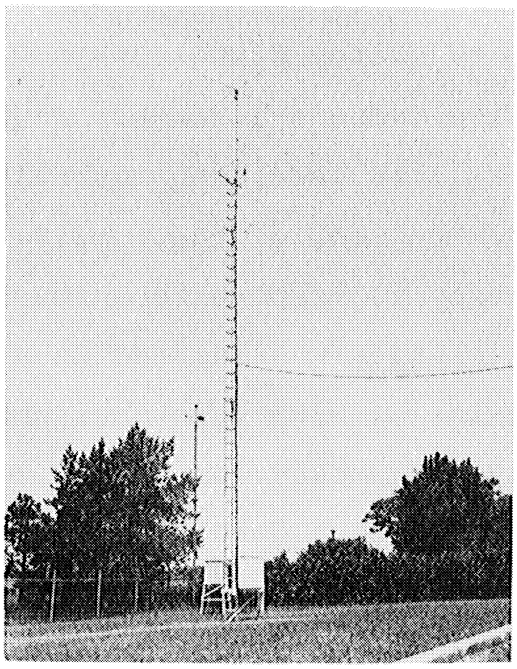

FIGURE 2. Lake shore station. An USWB-type instrument shelter at the foot of the 12.2 m meterological tower, which supports winds sensors and a radio telephone antenna.

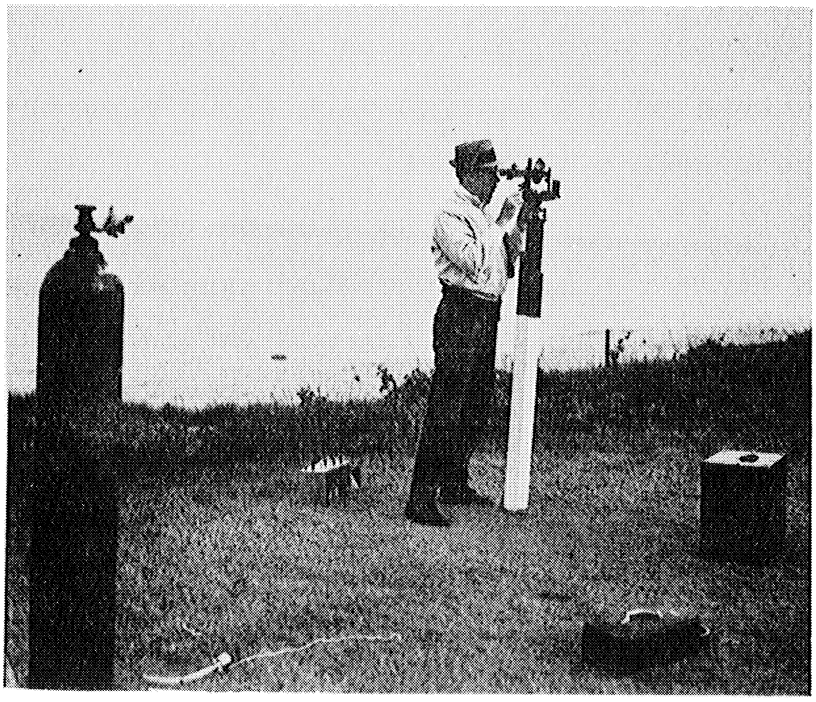

FIGURE 3. The north theodolite site at the Lake shore station viewed from the south-east. Lake Michigan in the background.

were located on the beach, south of the station, with a 305 m (1000 ft) north - south baseline. A Belfort Recording Pyrheliometer was located on the roof of the pumping station, approximately 10 m above the ground.

8 km station was located on a farm in flat terrain. A USWB-type instrument shelter, located approximately 100 m east of the farm buildings, housed a Bendix Friez Model 594 hygrothermograph. Close by the shelter, on the 12.2 m level of a 24.4 m guyed steel tower was located a Science Associates #418 wind direction sensor and a Science Associates #402 anemometer, Figure 4. Wind speed and direction were recorded on an Esterline-Angus 20 pen event recorder, Figure 5. Two theodolites were located on an open field to the south of the station with a 305 m north-south baseline, Figure 6.

16 km station was located on the lawn of a field station of the Michigan Department of Conservation. The lawn was shielded from open fields by hedges to the north and west, and by a small built-up area to the southeast. A USWB-type instrument shelter with a Bendix Friez Model 594 recording hygrothermograph and a 12.2 m guyed steel tower with a top mounted Science Associates #418 wind direction

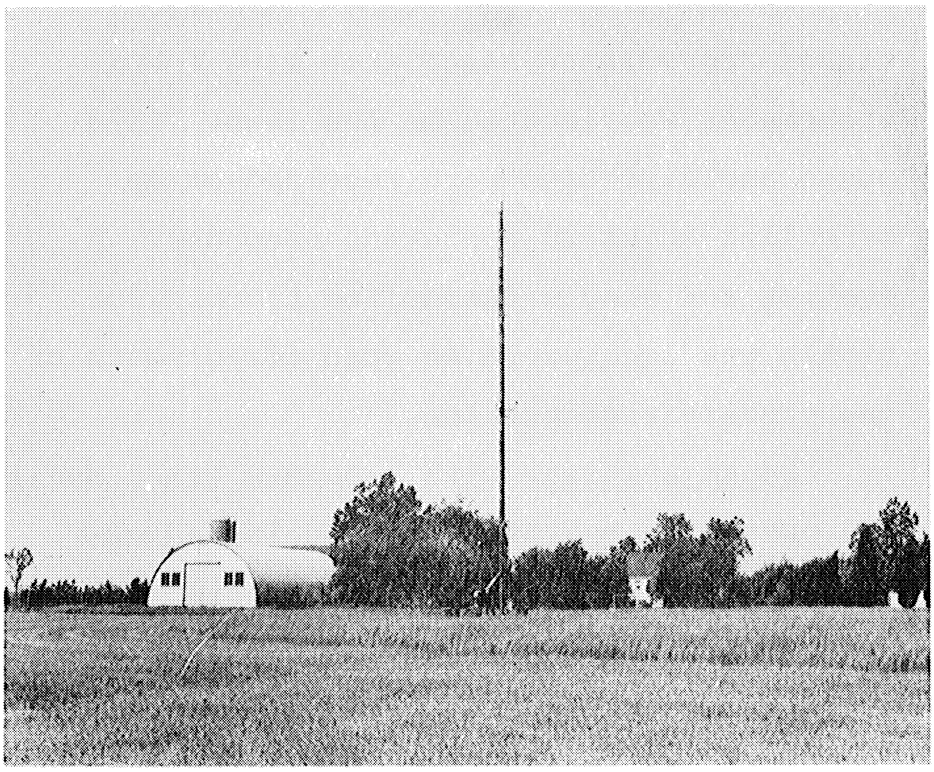

FIGURE 4. The meteorological tower at the 8 km station viewed from the east.

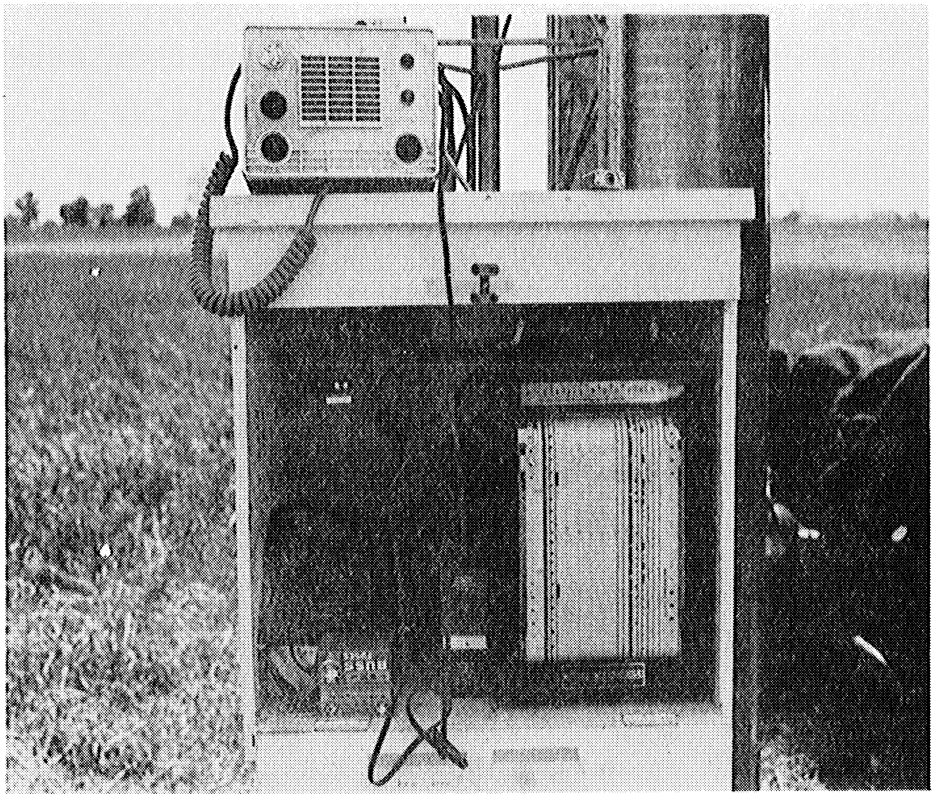

FIGURE 5. An Esterline-Angus 20 pen event recorder for wind speed and direction recording and a Messenger II, 5 watt Citizen's Band radio telephone.

sensor and Science Associates #402 3-cup anemometer was located on the lawn. Wind speed and direction were recorded on an Esterline-Angus 20 pen event recorder. A station for single theodolite tracking of pibals was located on an open field south of the conservation station.

24 km station, with a Bendix Friez Model 594 recording hygrothermograph in an USWB type instrument shelter, was located with open fields towards south and with wooded areas toward north.

WJBL station is a radio station located north of Holland, Michigan; x = 10 km and y = -17 km. The sensors were mounted on a 91.4 m high radio transmitting tower located on an open field, Figure 7. Copper constantan thermojunctions in Thornthwaite shields at the 2.4, 4.9, 9.8, 19.5, 39.0, and 78.0 m levels sensed air temperatures and copper constantan thermojunctions at 0.01, 0.10, and 1.00 m depths in the ground sensed soil temperatures. These temperatures were recorded on a Honeywell-Brown multipoint recorder. Electric Speed Indicator 3-cup anemometers and wind vanes type F-420-C were mounted at the 19.5, 39.0, and 78.0 m levels. Wind speeds and directions were

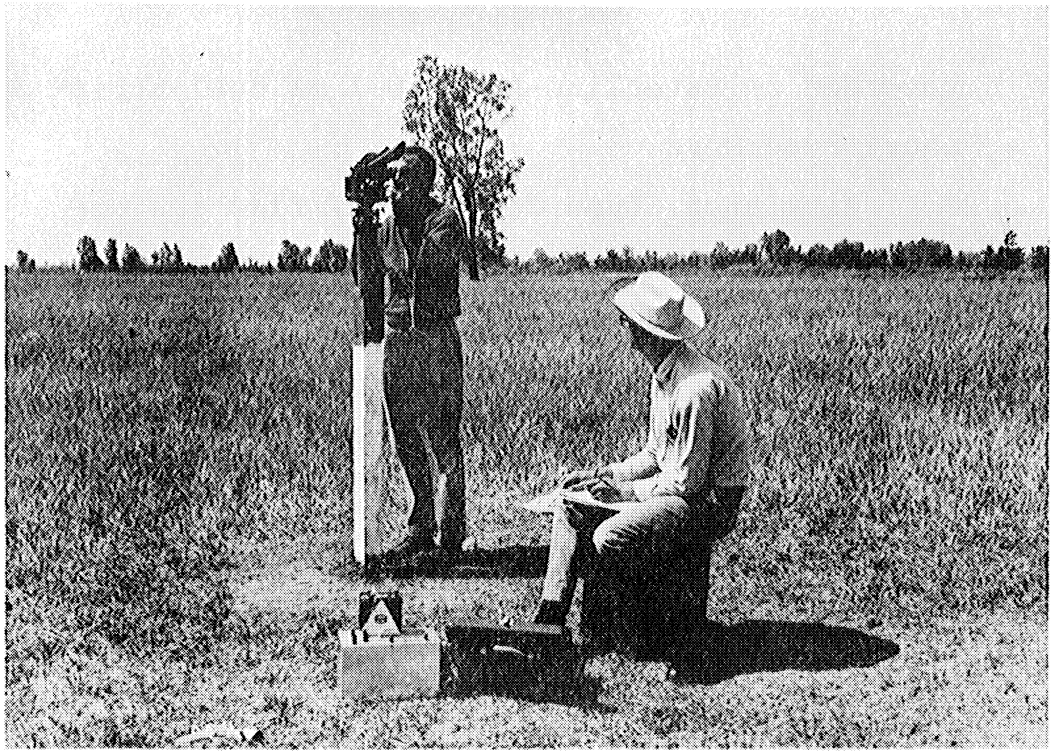

FIGURE 6. The north theodolite site at the 8 km station viewed from the west.

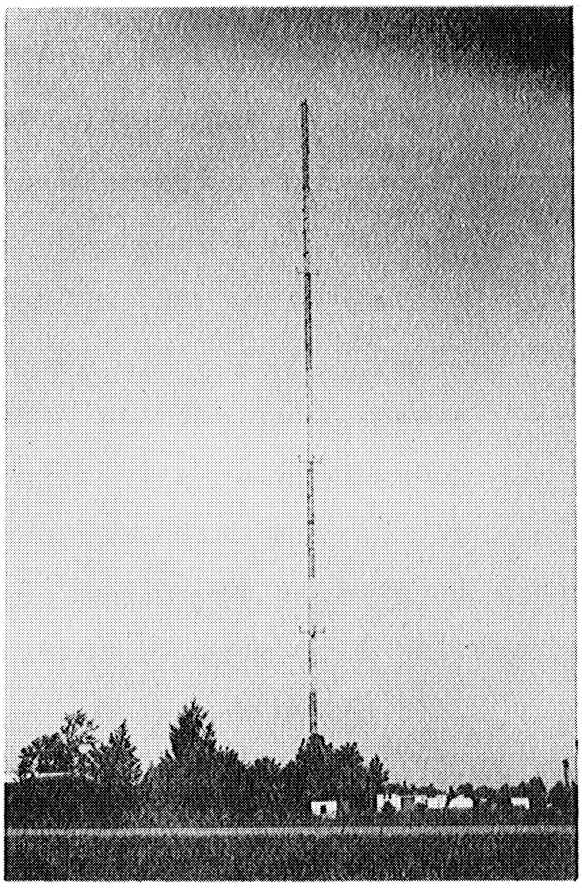

FIGURE 7. The WJBL 91.4 m high radio transmitting tower supporting wind and temperature sensors. The recorders are housed in the shelter at the foot of the tower.

recorded on Esterline-Angus 0-1 ma dual strip-chart recorders.

Airplanes, type Cessna 172, flew trajectories in a vertical plane along the observation line. They were equipped with Friez aerometeorographs for temperature and relative humidity recording, Figure 8, and with Yellow Spring Instruments Corporation thermistors, mounted in radiation shields, for instantaneous readings of air temperature and wet bulb temperature, Figure 9.

MYSIS is a fifty foot, steel hulled research vessel belonging to the Great Lakes Research Division of the Institute of Science and Technology, University of Michigan, Figure 10. She operated mainly 1.6 to 6.4 km off shore along the observation line. Bow and beam winds with respect to the vessel were measured with an Electric Speed Indicator 3-cup anemometer and wind vane type F-240-C mounted on the top of the ship's mast, 12.1 m above water surface. Air temperature was measured with a Rosemont Engineering platinum resistance thermometer system with sensors mounted in Thornthwaite-type radiation shields 11.8 m above water on the mast and at 5.1 m above water on the bowsprit. Water temperature was sensed at 1.2 m under the water surface. Humidity was

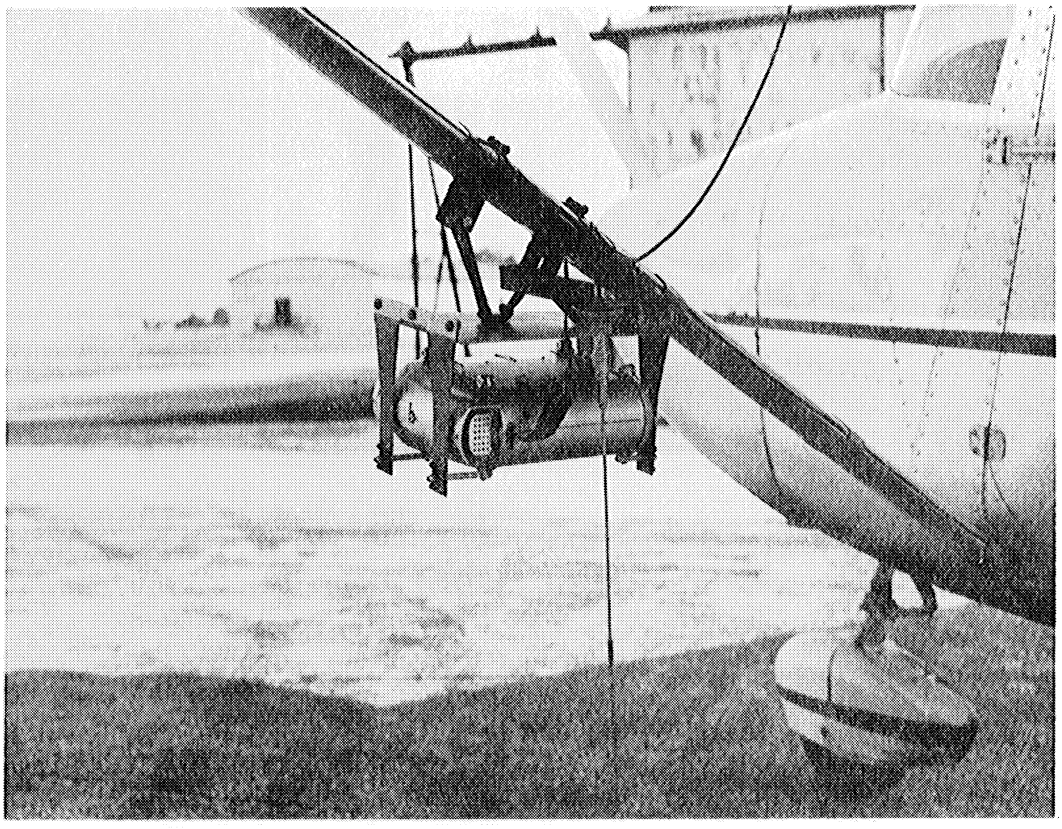

FIGURE 8. A Fritz aerometeorograph, mounted on left wing strout of a Cessna 172 aircraft.

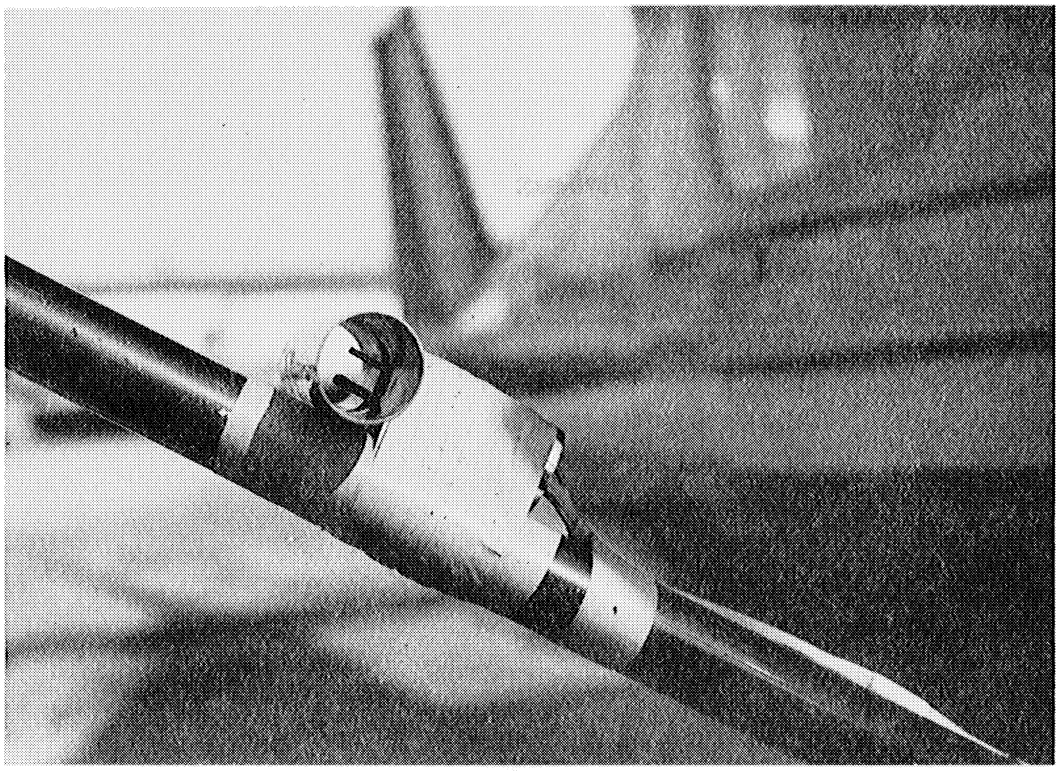

FIGURE 9. Yellow Spring Instrument Corporation Thermistors, for dry and wetbulb temperature sensing, in radiation shield mounted on right wing strout of a Cessna 172 aircraft.

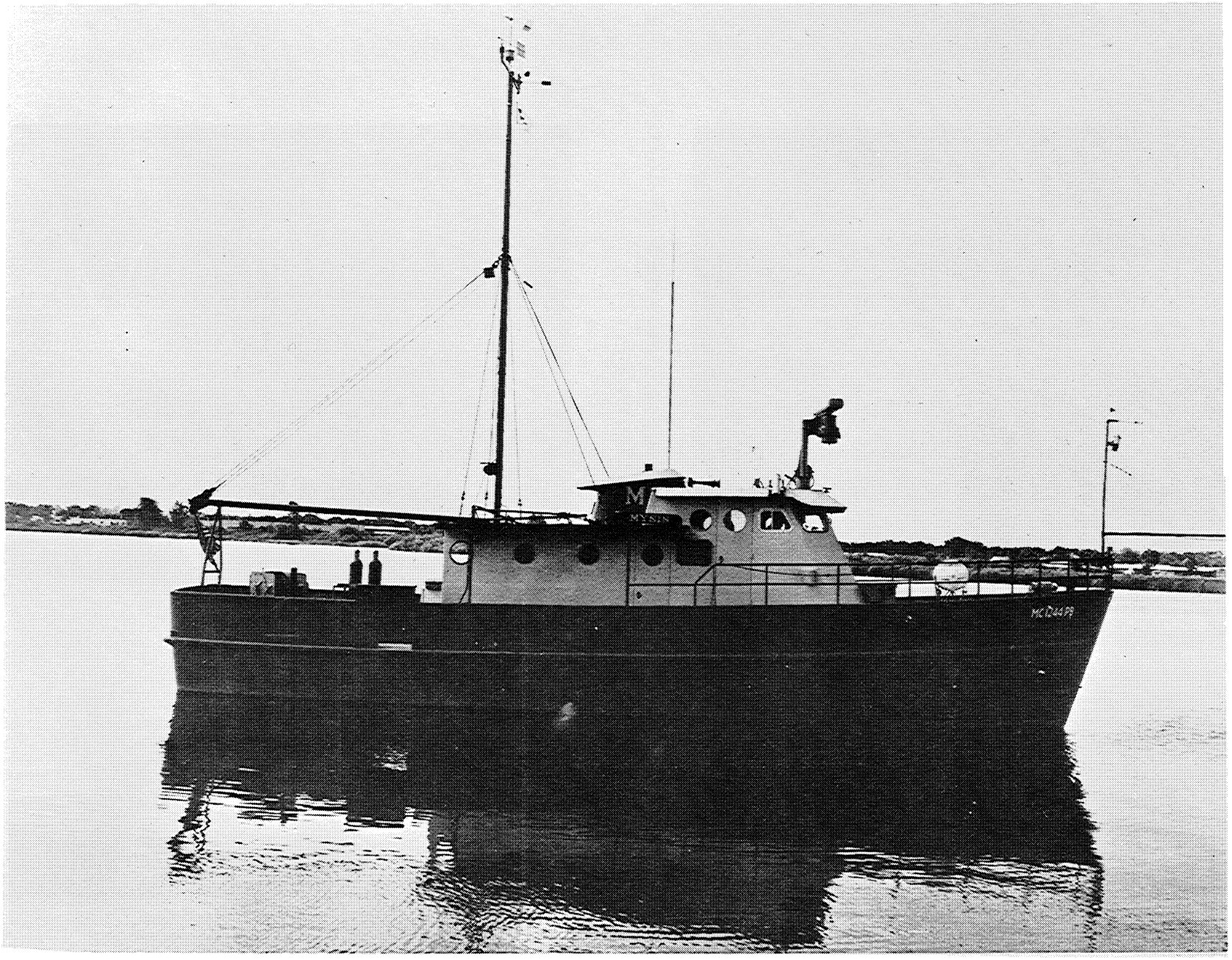

FIGURE 10. The R/V MYSIS equipped with temperature, humidity, radiation and wind sensors.

sensed with a Honeywell lithium chloride dew probe on a bow mounting at 5.0 m above the water. Solar radiation was sensed by an Eppley solar radiation sensor mounted on top of the wheelhouse. Ship speed and heading were set manually, as was the date, while a digital clock produced time signals with one minute resolution. All instruments onboard the MYSIS were recorded on an Information Instruments Inc. data logger model 641. This data logger converts analog voltage signals to digital form and records them on punched paper tape. Sampling time was in the order of milliseconds, with each sensor sampled and recorded once per minute. Releases of pilot balloons, for either shipboard tracking with marine theodolite or shoreline tracking with standard theodolites, were made.

All instruments on the previously mentioned stations were checked frequently and corrected, e.g. the hygrothermographs were checked once a day against sling psychrometers. Communication between the different observational sites was provided by three Messenger II, and one Hallicrafters transistorised, 5 watt, Citizen's Band radio telephones. At the locations for double theodolite tracking, field tele-

phones and buzzers were used between the two theodolites for coordination and timing. Smoke plume generation and smoke plume photography as well as measurements of wind fluctuation with Gill anemometer bivanes were made at various observational sites. Results of these findings will be reported elsewhere.

MKG is a USWB station located on the eastern side of Muskegon airport, 6.5 km inland from the shoreline, at coordinates $x = 0$, and $y = 21$ km.

GRR is a USWB station located at Grand Rapids airport at $x = 53$ and $y = -10$ km.

Both MKG and GRR make routine observations on the hour.

Lake Tower is a research tower belonging to the Great Lakes Research Division and located at $x = -7$ and $y = 22$ km, 1.8 km off shore, Elder (1964). Windspeeds and directions are sensed by an Aerovane mounted 15.0 m above water and recorded on a data logger.

Auxiliary observations made at USWB-stations, U.S. Coast Guard stations, and on-board ships on the Great Lakes have been used in describing the synoptic situation and in evaluating the large scale situation, but are not tabulated in this report.

Most of the data presented in this report have been abstracted and analyzed at the Department of Meteorology and Oceanography of the University of Michigan, and are punched on IBM cards. Some of the data are stored on magnetic tape. Temperature, humidity, wind, and radiation data are tabulated and presented as appendices in this report. At WJBL a temperature is recorded on a twelve point recorder at one half minute intervals, thus making a recording of the temperature at each level every six minutes. The temperature record was abstracted by reading one cycle of recordings at half hour intervals. Temperatures and relative humidities at the Lake shore, 8 km, 16 km, and 24 km stations were read from hygrothermograph-charts as "preceding 1/2 hour averages" or "preceding 1 hour average". Dew point temperatures at these stations were obtained from tables. Winds at the WJBL, 8 km, and 16 km stations are read from strip charts as "preceding 1/2 hour averages", or "preceding 1 hour averages". Winds at the lake shore were estimated averages from neighboring U.S. Coast Guard stations, while solar radiation for the station was taken from the pyrheliometer

chart as "centered 1/2 hour averages". Wind data from the Lake tower were taken as "centered 1 hour averages". Data from MYSIS were taken as "centered 5 minutes averages", on every half hour, from the print out of the datalogger's punched papertape, whenever the ships location so warranted. Data from MKG and GRR were taken from these USWB stations hourly observation records. Dry bulb and wet bulb temperatures obtained from the airplane flights were read from the Yellow Spring Instrument recorder as instantaneous values at height increments of 152 m.Corresponding times and horizontal distances (x-values) were given. Relative humidity was obtained from psychrometric tables and vapor pressure was computed.

Winds aloft data were determined from theodolite tracking of pilot balloons. Analyses of the tracks were made on a digital computer. The analysed runs are summarized in Table 1, and components across shore (u), along shore (v), total horizontal (VT), and in the cases of double theodolite tracking, vertical winds (w) are listed in Table A5 together with balloon coordinates (x,y,z) at any given time after balloon release.

TABLE 1.

A summary of available winds aloft observations for June 25, 1965. "D" indicates that double theodolite tracking and analyses were used and "S" that single theodolite analyses were made. Superscript 1 indicates "balloon released from MYSIS", from distance off shore as given in km in MYSIS column. Numbers in brackets are duration of track in minutes.

Time	Lakeshore	8 KM	16 KM	MYSIS
0600	D_1 (20.0)			
0630	S^1 (13.0)	S (20.0)		-1.6*)
0700		S (20.0)		
0730		S (20.0)		*) Not tracked from MYSIS
0800	D (20.0)	S (20.0)		
0830	D_1 (20.0)	S (20.0)		
0900	S^1 (20.0)	S (20.0)		-1.6 (12.5)
0930	D (20.0)	S (20.0)		
1000	D (20.0)	S (20.0)		
1030	D (20.0)	S (20.0)		
1100	D (13.0)	D (20.0)		-6.4 (12.5)
1130	D_1 (19.5)	D (20.0)		
1200	D^1 (20.0)	D (20.0)		-1.3 (12.5)
1230	S (20.0)	S (20.0)		
1300	S (20.0)	S (20.0)		
1330	D (20.0)	D (20.0)		
1347				-6.4 (12.5)
1400	D (20.0)	D (18.0)		
1430	D (20.0)	D (17.0)		
1500	S (20.0)	D (20.0)		
1530	S (20.0)	D (15.0)		
1600	S (20.0)	D (6.0)		
		S (20.0)		
1630	S (20.0)	D (15.0)		
1700	S (20.0)	D (15.0)	S (15.0)	
1730	S (20.0)		S (15.0)	
1800	D (9.0)	D (15.0)	S (7.0)	
	S (20.0)			
1830	D (20.0)	D (11.0)	S (8.5)	
1900	D (20.0)	D (15.0)	S (14.5)	
1930			S (15.0)	
1945	D (20.0)			
2000		S (15.0)		
2015	S (8.5)			
2030	D (6.5)			
	S (15.5)			

30 gram balloons, inflated at land stations with hydrogren to have an ascent rate of 183 m min^{-1} (600 ft min^{-1}) and onboard the ship with helium (for safety reasons) to have an ascent rate of 180 m min^{-1}, were used. Theodolite observations were made at 1/2 minute intervals to permit analysis for winds through thin layers in order that details of flow changes with height could be discerned. No weighting functions were used to smooth the data, although some smoothing is introduced by using the conventional technique of averaging over two layers to evaluate the wind at the midpoint. As can be seen from Table 1 some of the balloon flights were analysed, both as double and as single theodolite runs in order to determine errors made by assuming a constant ascent rate. These comparisons showed that the inherent error of wind analyses using single theodolite observations in very few cases exceeded $\pm$ 1 m sec^{-1} for land based theodolites and only in cases of balloon elevations over 1500 meters for the shipboard theodolite. In general the accuracy estimated by Frizzola and Fisher (1963) and by Moroz (1965) of $\pm$ 2 m sec^{-1} for single theodolite observations in sea and lake breezes, respectively, holds for the results presented here.

3. PREVAILING METEOROLOGICAL CONDITIONS, 25 JUNE, 1965.

On 25 June, 1965 the Lake Michigan basin was under the influence of a cold surface high, with a very weak pressure gradient over the entire Great Lakes region, Figure 11. During the day "mesoscale lake highs" developed over Lake Michigan and Lake Huron. In the late afternoon these highs had reached intensities of 3 - 4 millibars, Figures 12 - 14. Surface winds around Lake Michigan were light and variable in the morning hours. In the afternoon the surface winds reported from stations close to the shore, i.e. Muskegon, Chicago, Milwaukee, and Escanaba indicate lake effects around the entire lake. Similarly surface winds from stations around the other Great Lakes show clear evidence of lake effects. The winds aloft were weak and variable as a high pressure ridge moved in over the area, Figures 15 - 20 and lower insert on Figure 11. No clouds were sighted near the eastern shore of the lake at any time during the day. The solar radiation measured at the Lake shore is presented in Figure 21. The total intergrated solar radiation for 25 June, 1965 was 672 cal cm^{-2} day^{-1}, which is in good agreement with values given by CRREL (1964). The sun rose at 0506 and set at 2029 EST.

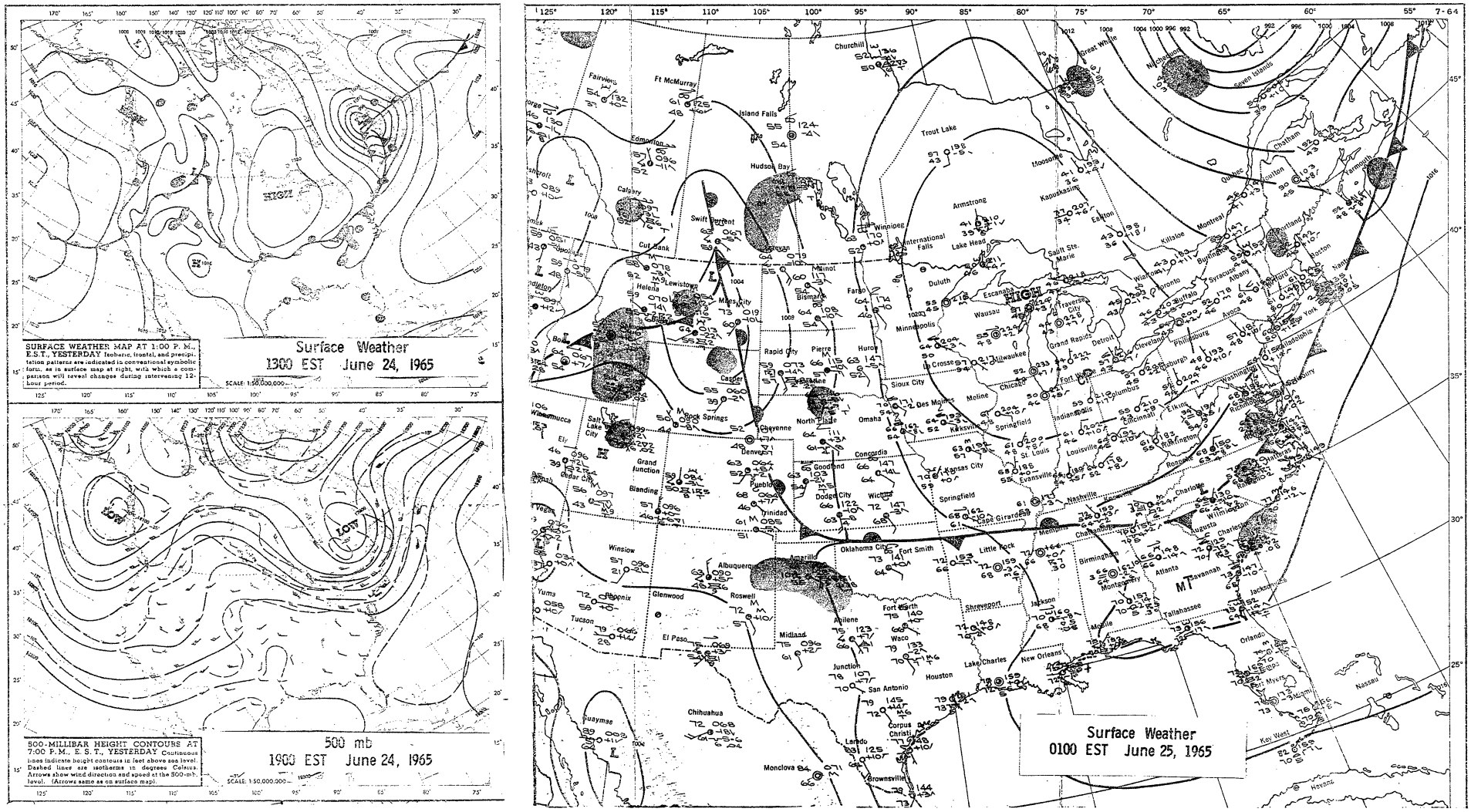

FIGURE 11. U.S. Weather Bureau Daily Weather Map at 0100 EST, 25 June, 1965. Upper insert shows the sea level isobars at 1300 EST, 24 June and the lower insert shows the height contours for the 500 mb surface at 1900 EST, 24 June.

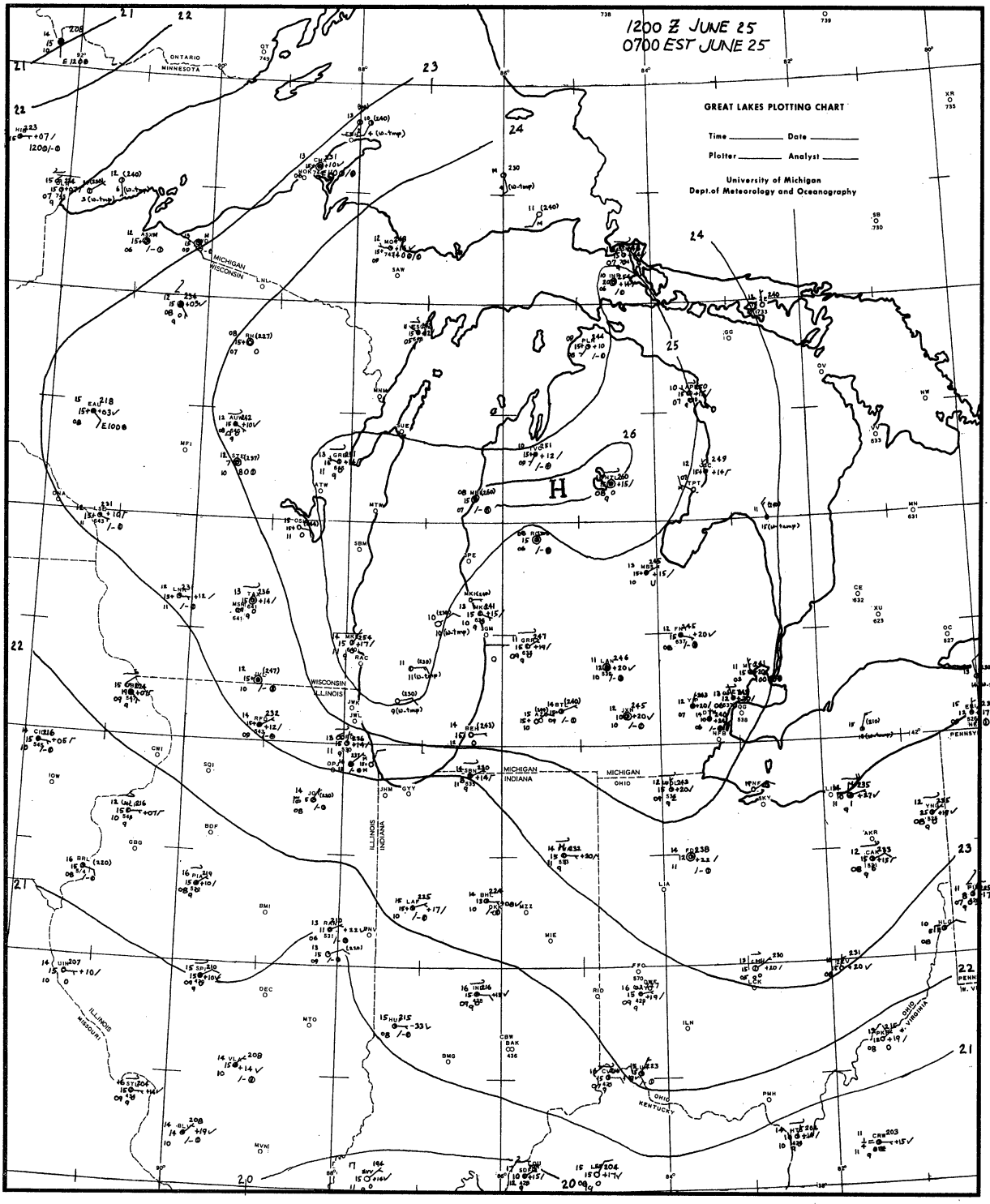

FIGURE 12. Mesoscale surface weather map and station weather at 0700 EST, 25 June, 1965.

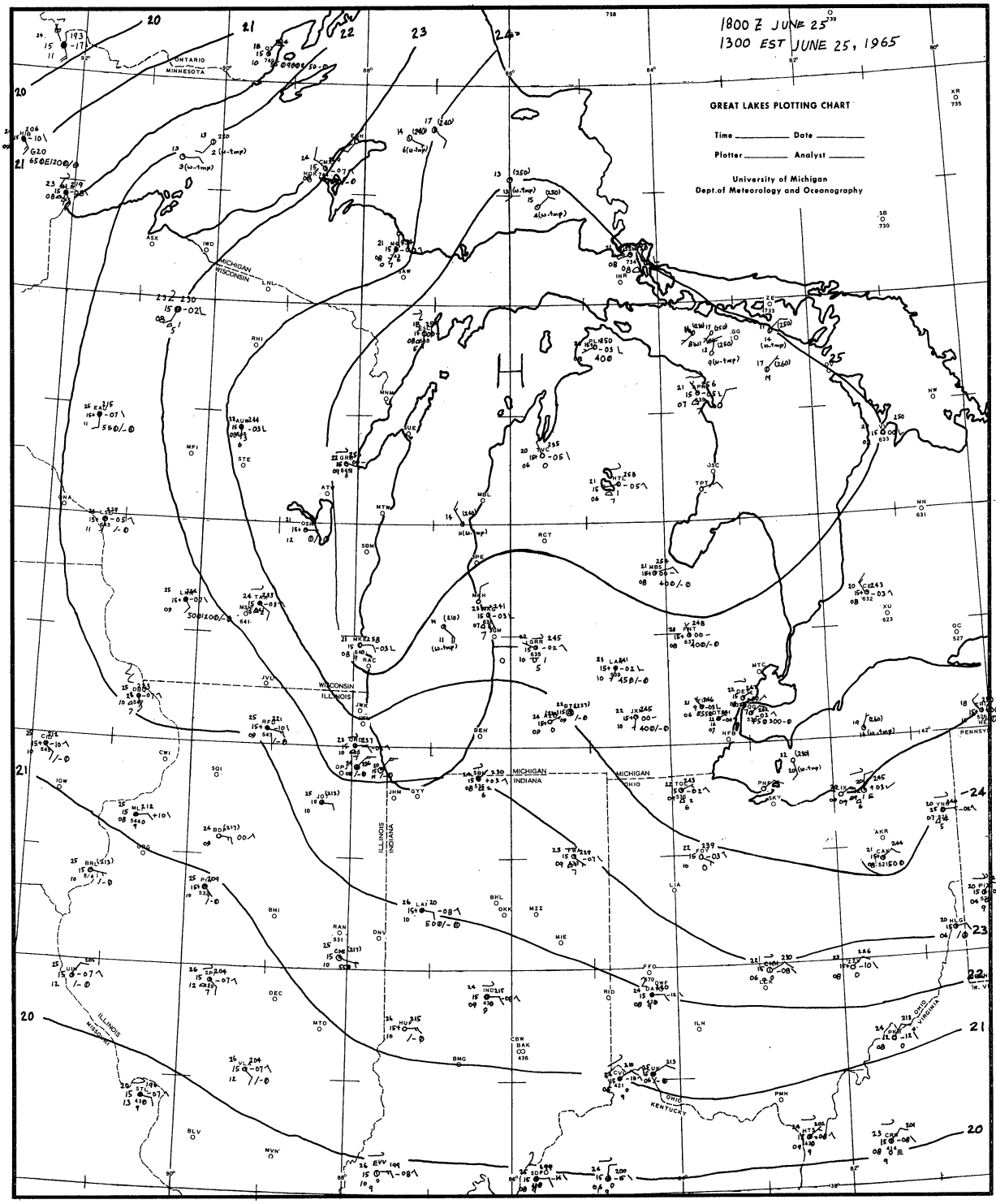

FIGURE 13. Mesoscale surface weather map and station weather at 1300 EST, 25 June, 1965.

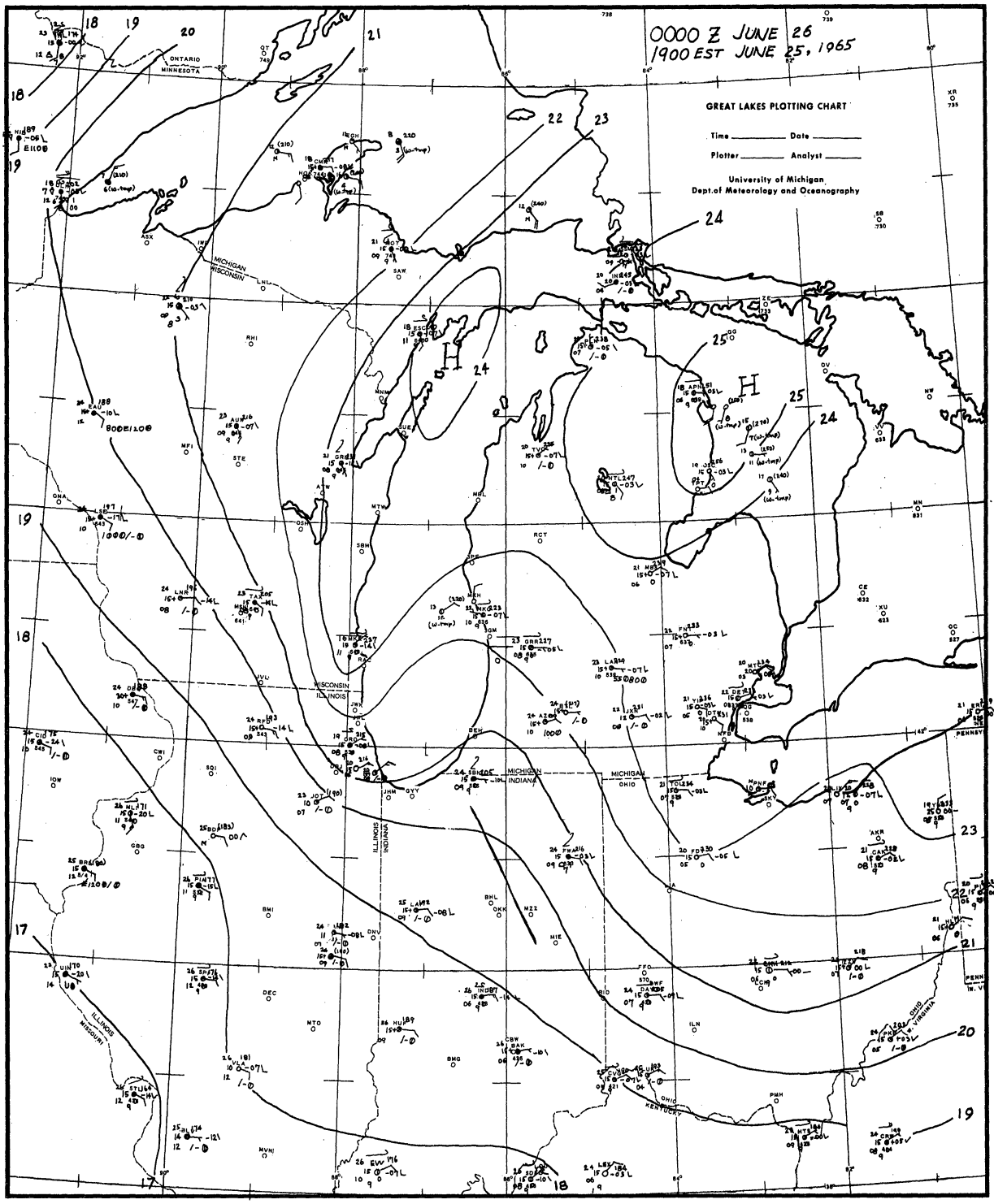

FIGURE 14. Mesoscale surface weather map and station weather at 1900 EST, 25 June 1965.

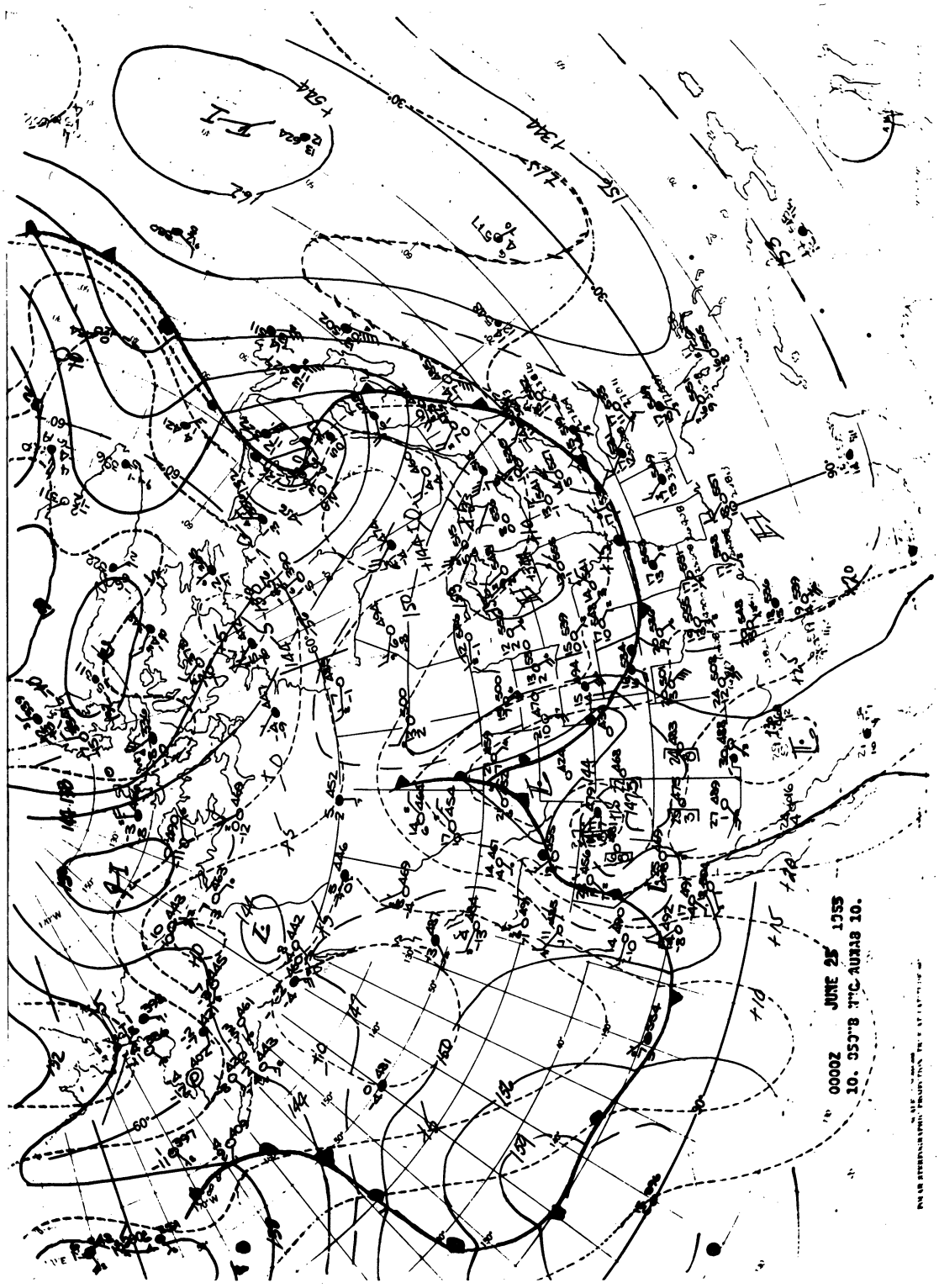

FIGURE 15. Height contours for the 850 mb surface at 1900 EST, 24 June, 1965.

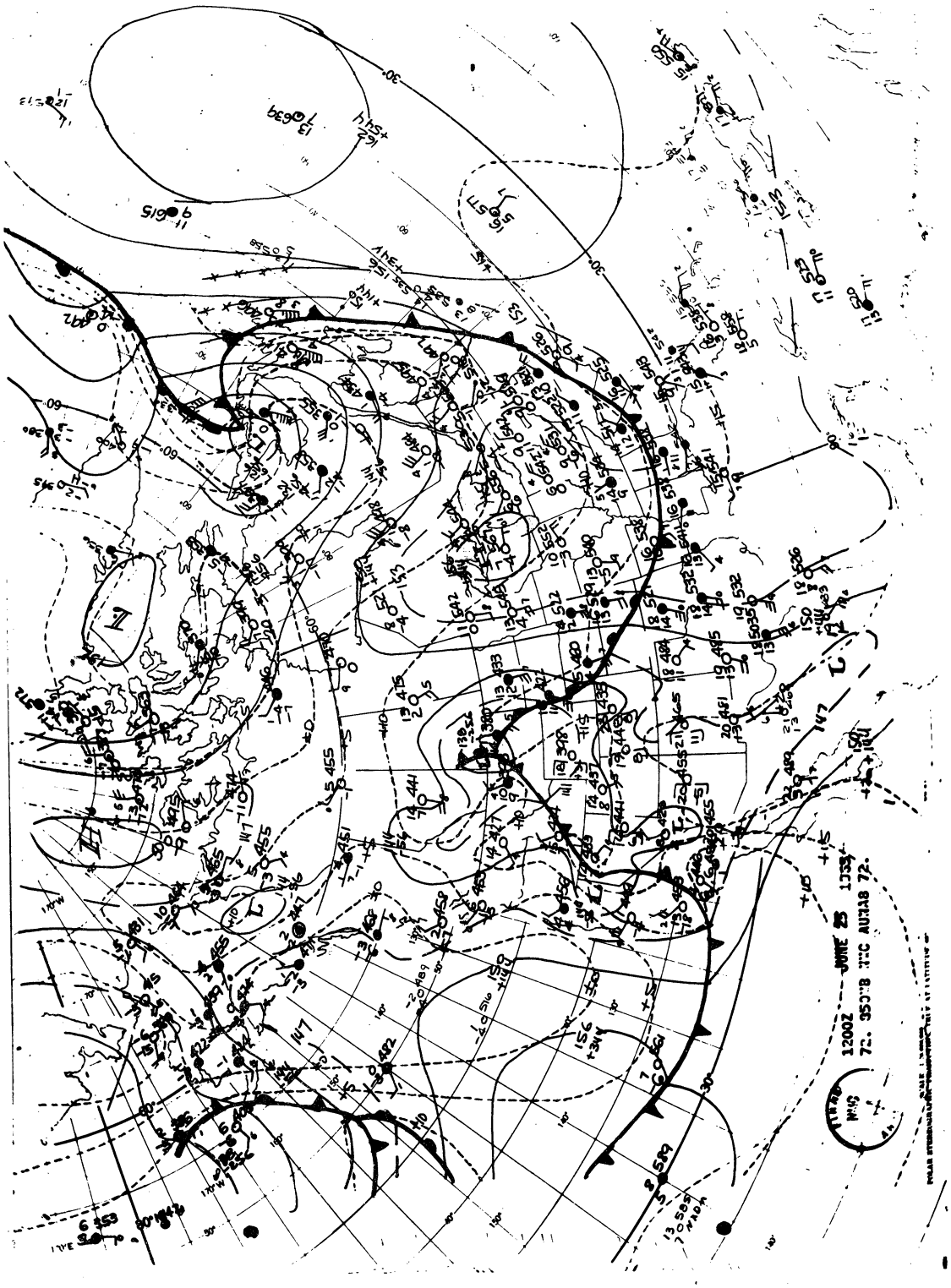

FIGURE 16. Height contours for the 850 mb surface at 0700 EST, 25 June, 1965.

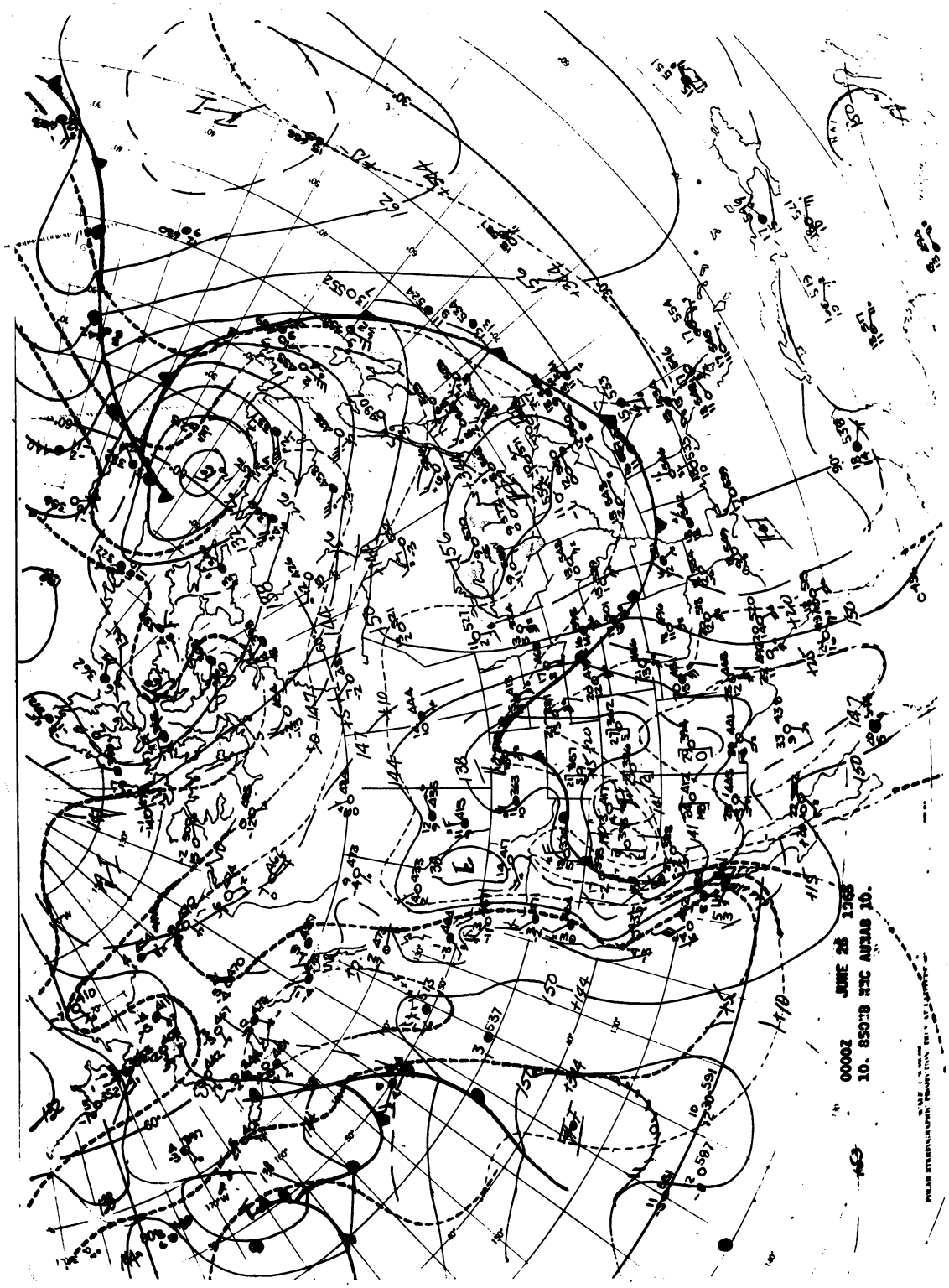

FIGURE 17. Height contours for the 850 mb surface at 1900 EST, 25 June, 1965.

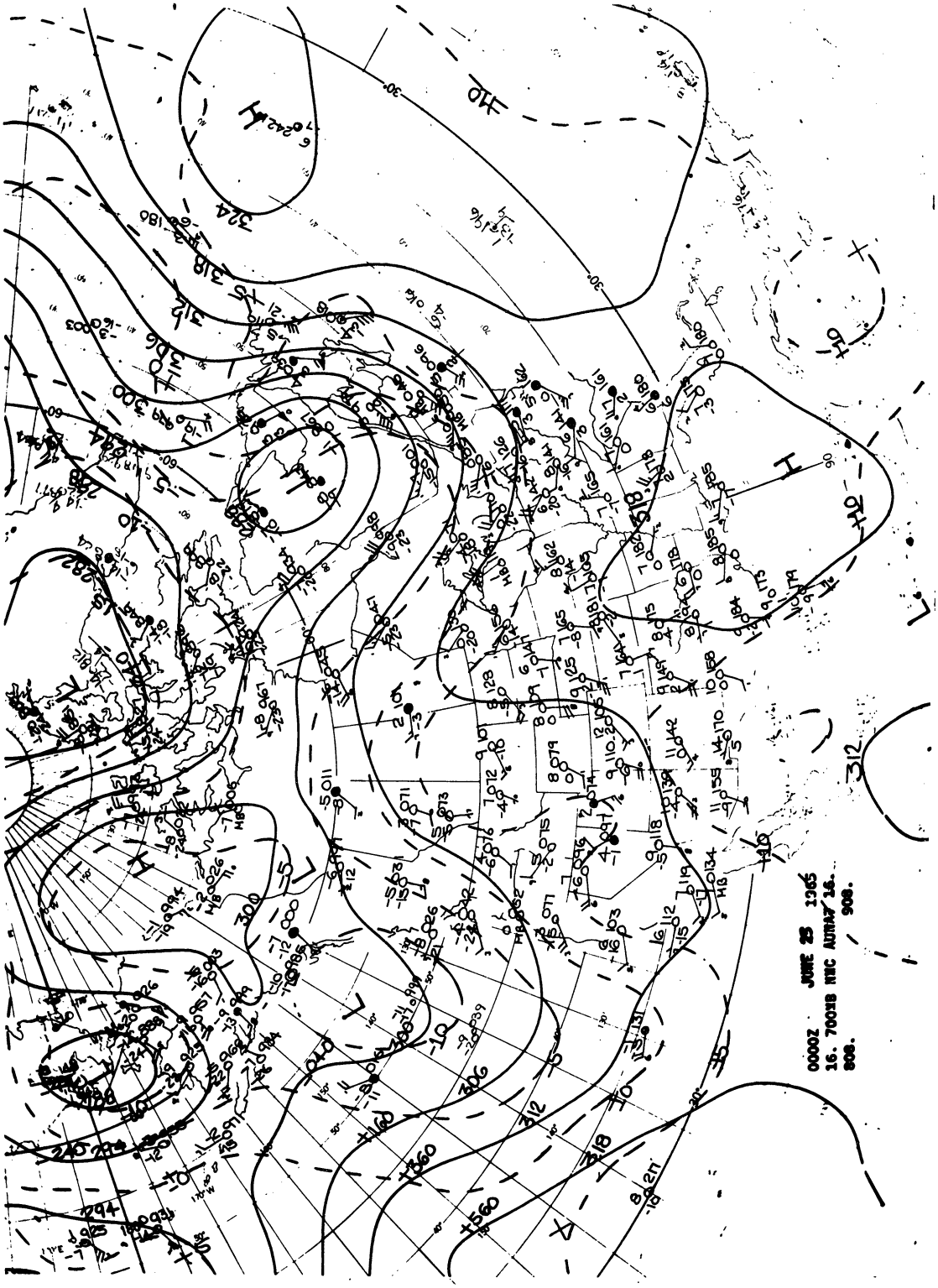

FIGURE 18. Height contours for the 700 mb surface at 1900 EST 24, June, 1965.

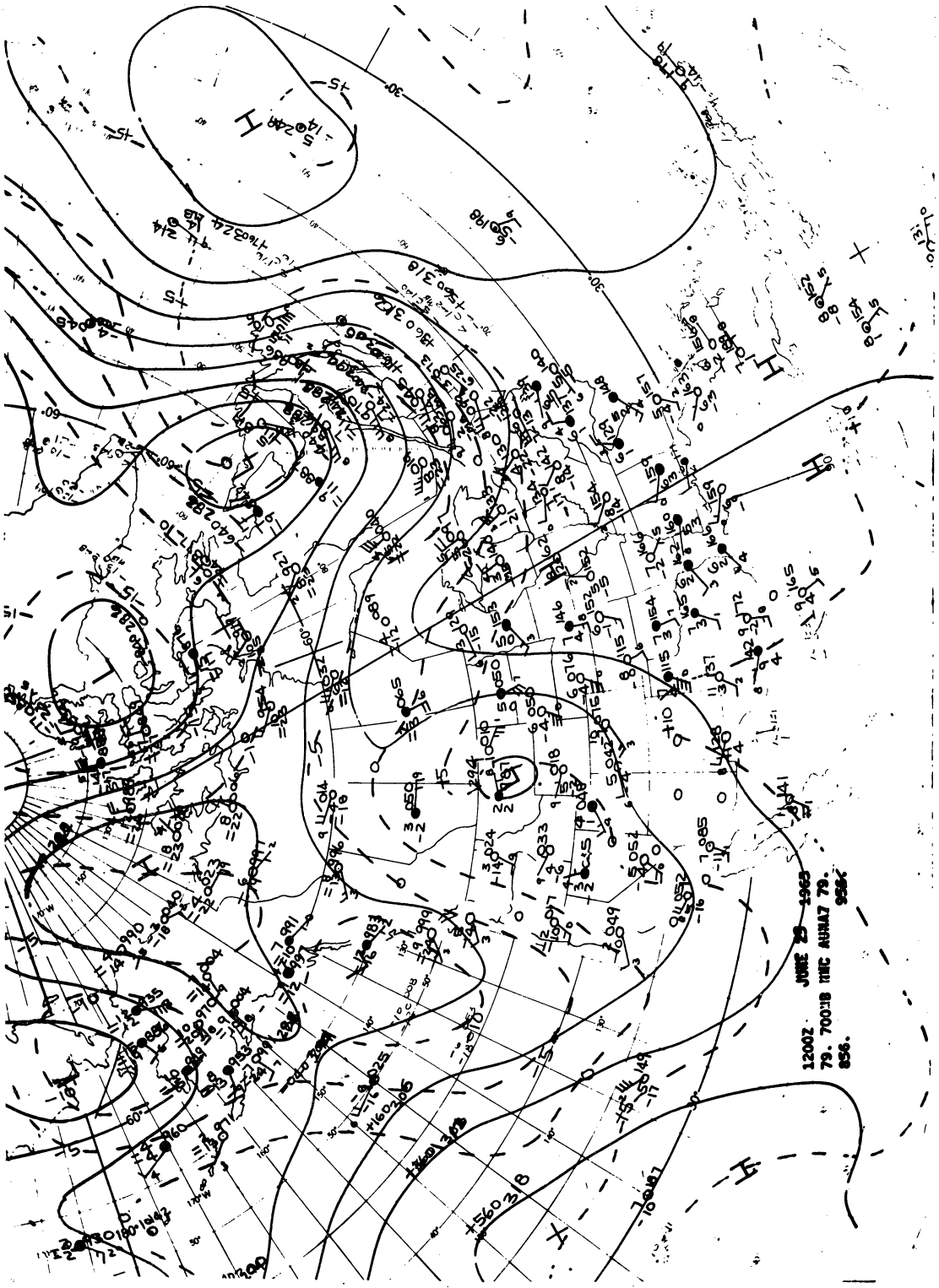

FIGURE 19. Height contours for the 700 mb surface at 0700 EST, 25 June, 1965.

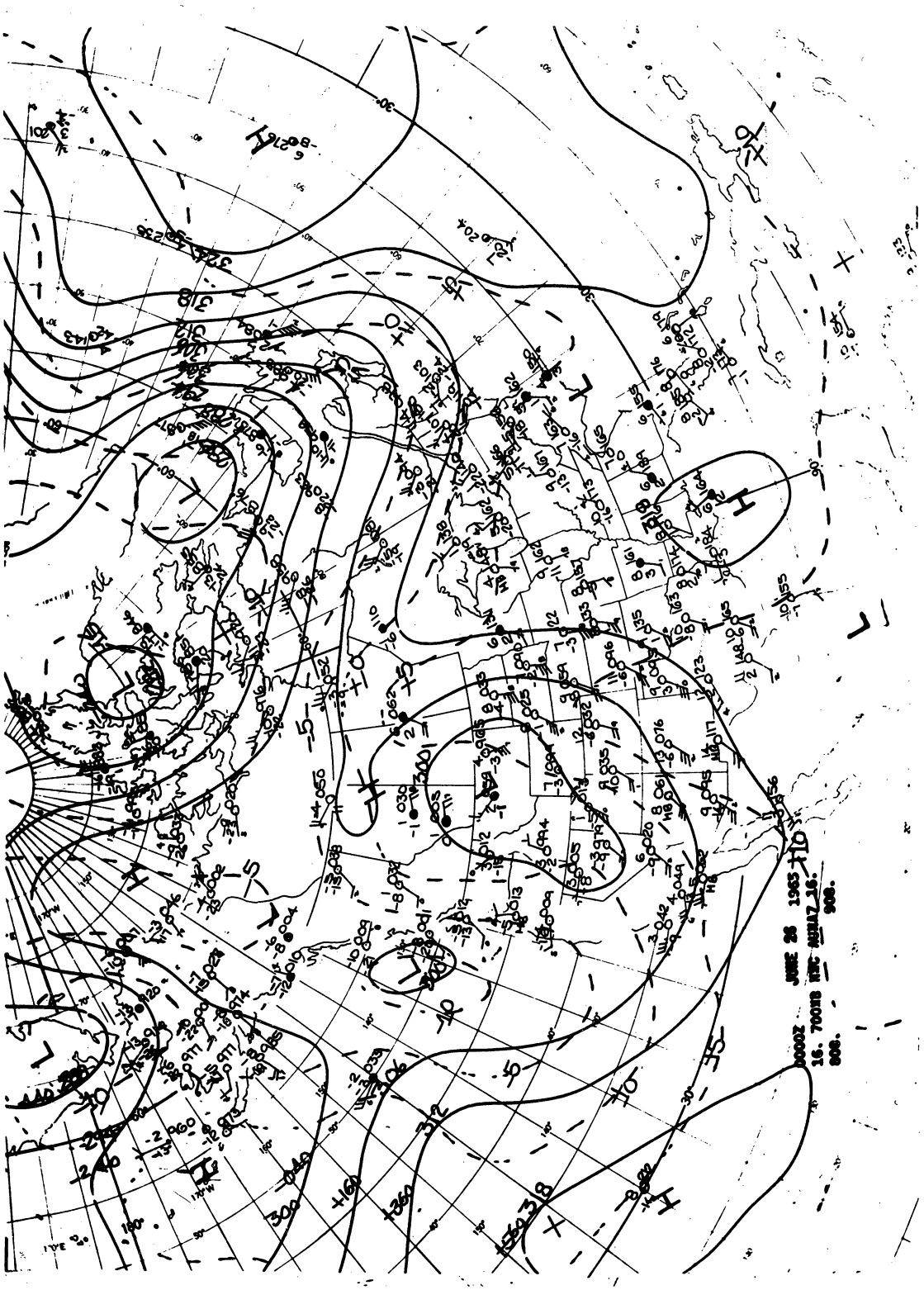

FIGURE 20. Height contours for the 700 mb surface at 1900 EST, 25 June, 1965.

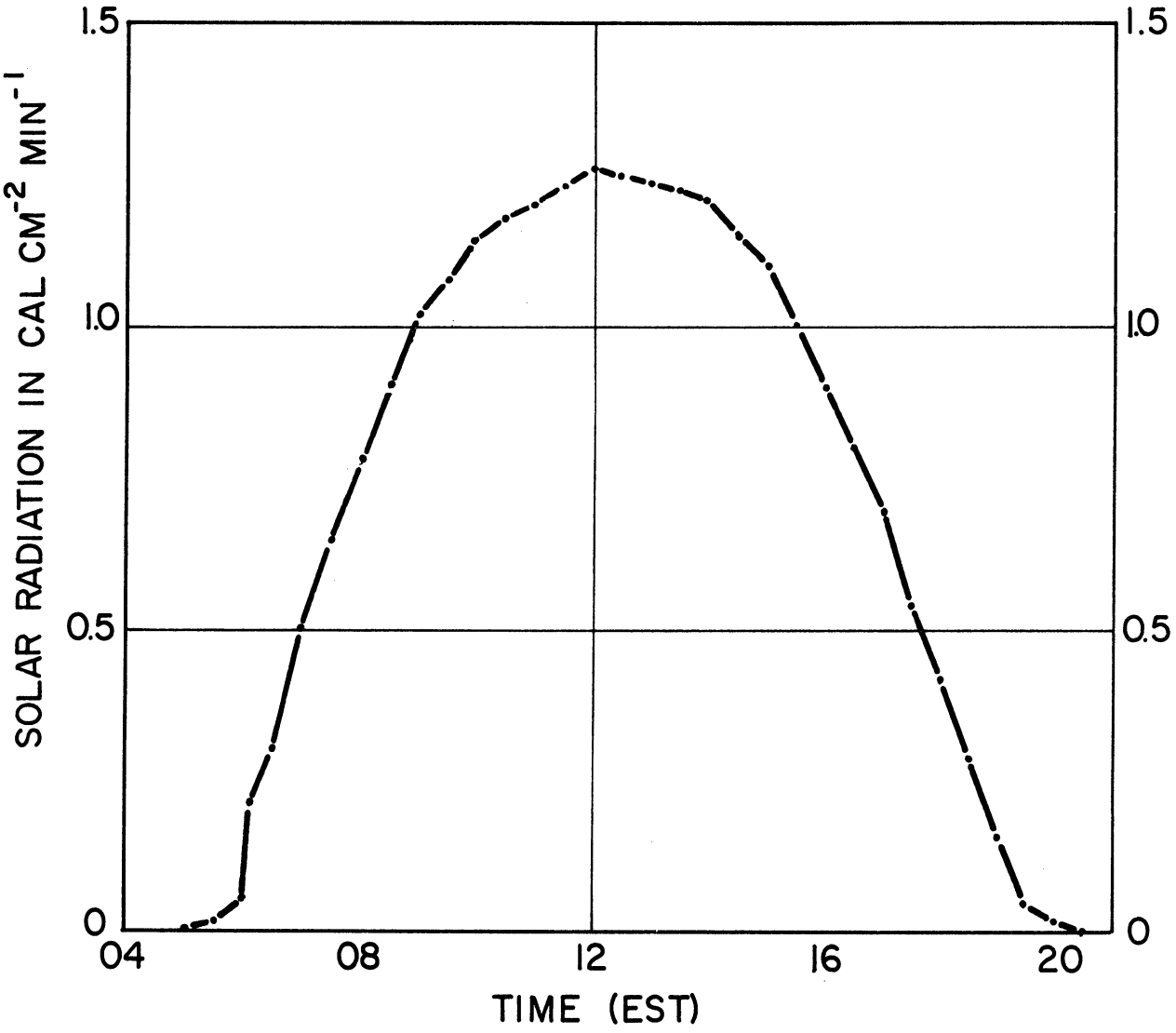

FIGURE 21. Solar radiation recorded at the Lake shore station on 25 June, 1965.

4. OBSERVED TEMPERATURES, HUMIDITIES, AND WINDS

This section includes graphical and written presentations of observed temporal and spatial variations of temperature, moisture, and wind.

4.1 TEMPERATURE AND MOISTURE

The lapse rates measured in the lowest 80 m at WJBL at various times are presented in Figure 22, together with the temperature profiles in the first meter of the soil. The data used for these plots are presented in Table A2. While the diurnal temperature fluctuation at 1 m depth was less than 1.2°C, the difference between maximum and minimum temperatures at the surface (1 cm below the surface) was 26.0°C. At all times the air temperature recorded at the 2.4 m level was lower than those recorded at the surface. The problem with correct measurement of the surface temperature is well recognized. The top soil is "penetrated by", and rapidly responds to solar heating, while the response to nocturnal cooling is slow and retarded by heat flux through the soil. The nocturnal inversion was broken at sunrise. At 1300 EST a super-adiabatic layer was present up to approximately 40 m. At 1600 EST the effect of the incoming lake breeze was seen in the lowering of the temperature in the lowest layers. The return to a nocturnal inversion condition after sunset was observed.

In Figure 23, lapse rates obtained from airplane data are presented. The data used

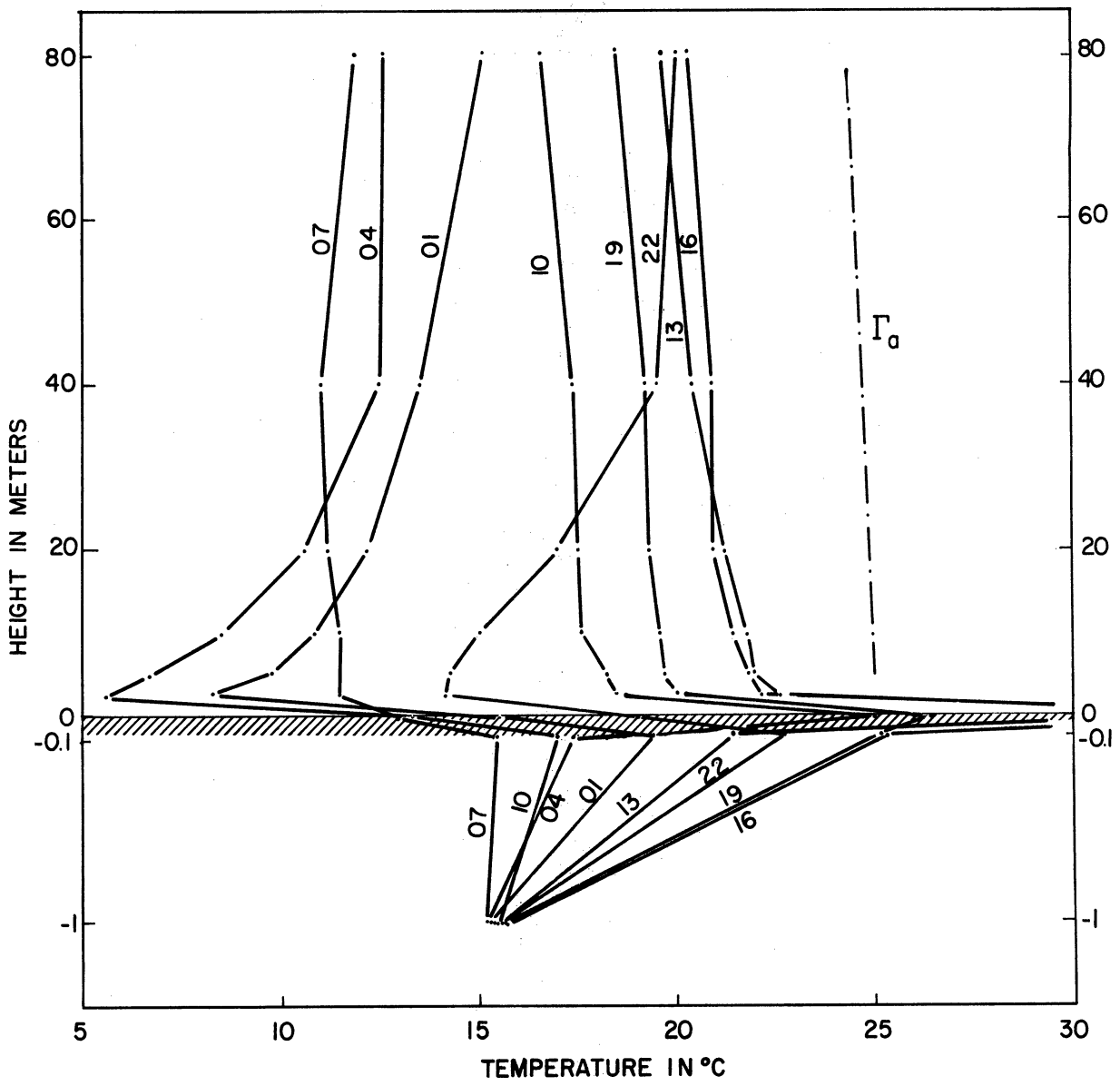

FIGURE 22. Lapse rates and soil temperature as a function of time at WJBL tower on 25 June, 1965. Times indicated in Figure are EST.

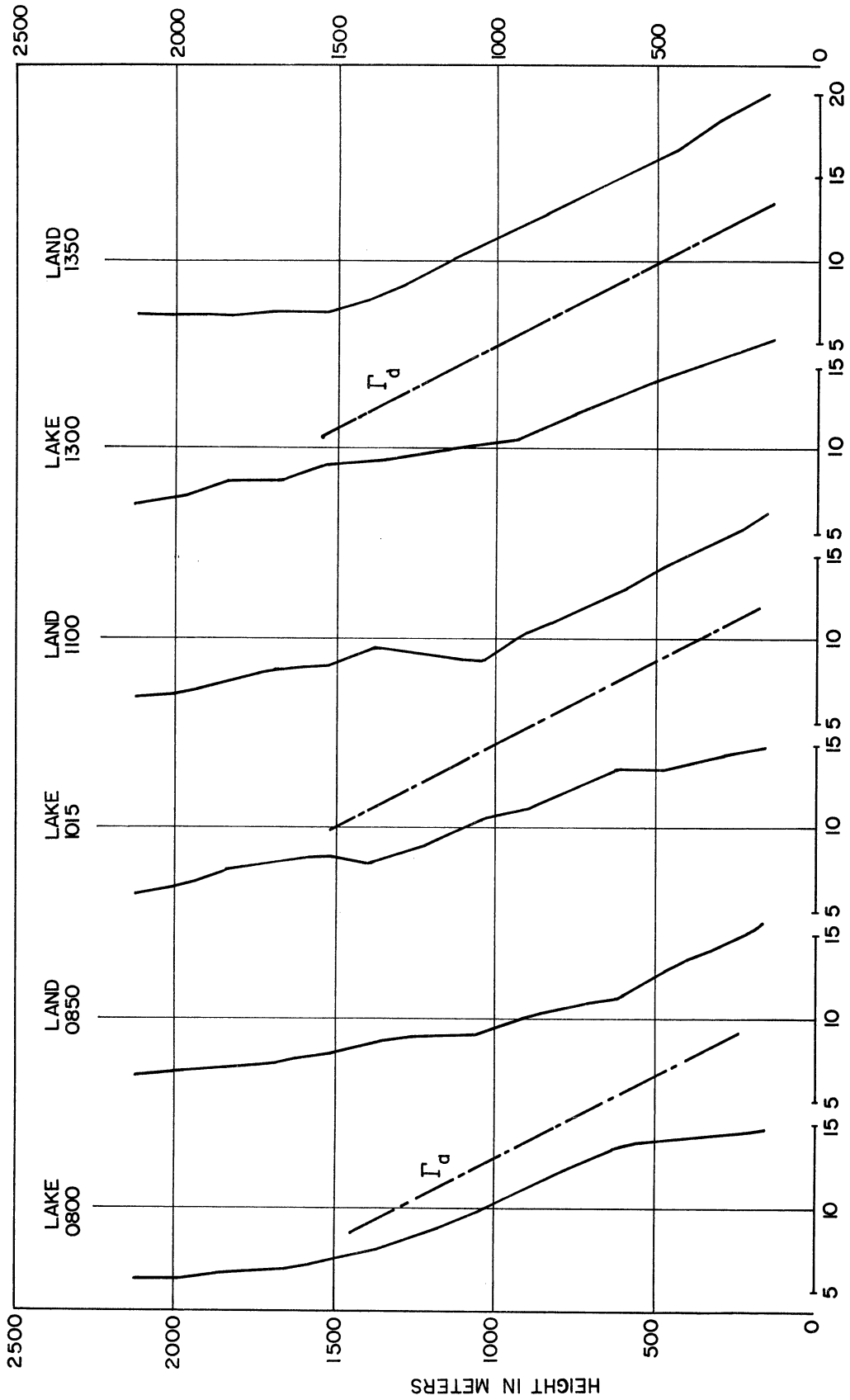

FIGURE 23. Lapse rates over lake and over land at various times on 25 June, 1965.

in the presentation are tabulated in Table A3. The airplanes ascended over the lake at x = -32 km, y = 0 km and decended over land at x = 32 km, y = 0 km. The times for the beginning of the ascent and descent are given on the figure. While the air over land assumed near adiabatic lapse rate below 1500 m in the early afternoon, the air over the lake remained relatively stable in response to the colder surface water and subsidence due to the lake breeze circulation.

Vertical temperature cross sections along the observation line are presented in Figures 24-26. In order that data collected at and near the surface could be used, a logarithmic height scale is used. The data used for the Figures are tabulated in Tables A1-A3. Figures 24-26 illustrate how the air over land was warmed and that the air temperature over the lake changed very little. It should be noted that a horizontal temperature gradient across the shoreline of approximately 1.2^{o}C km^{-1} (6^{o}C in 5 km) had been formed in the early afternoon.

Figure 27 presents temperatures as a function of time at various stations and at various distances from shore, as well as water temperatures recorded onboard MYSIS.

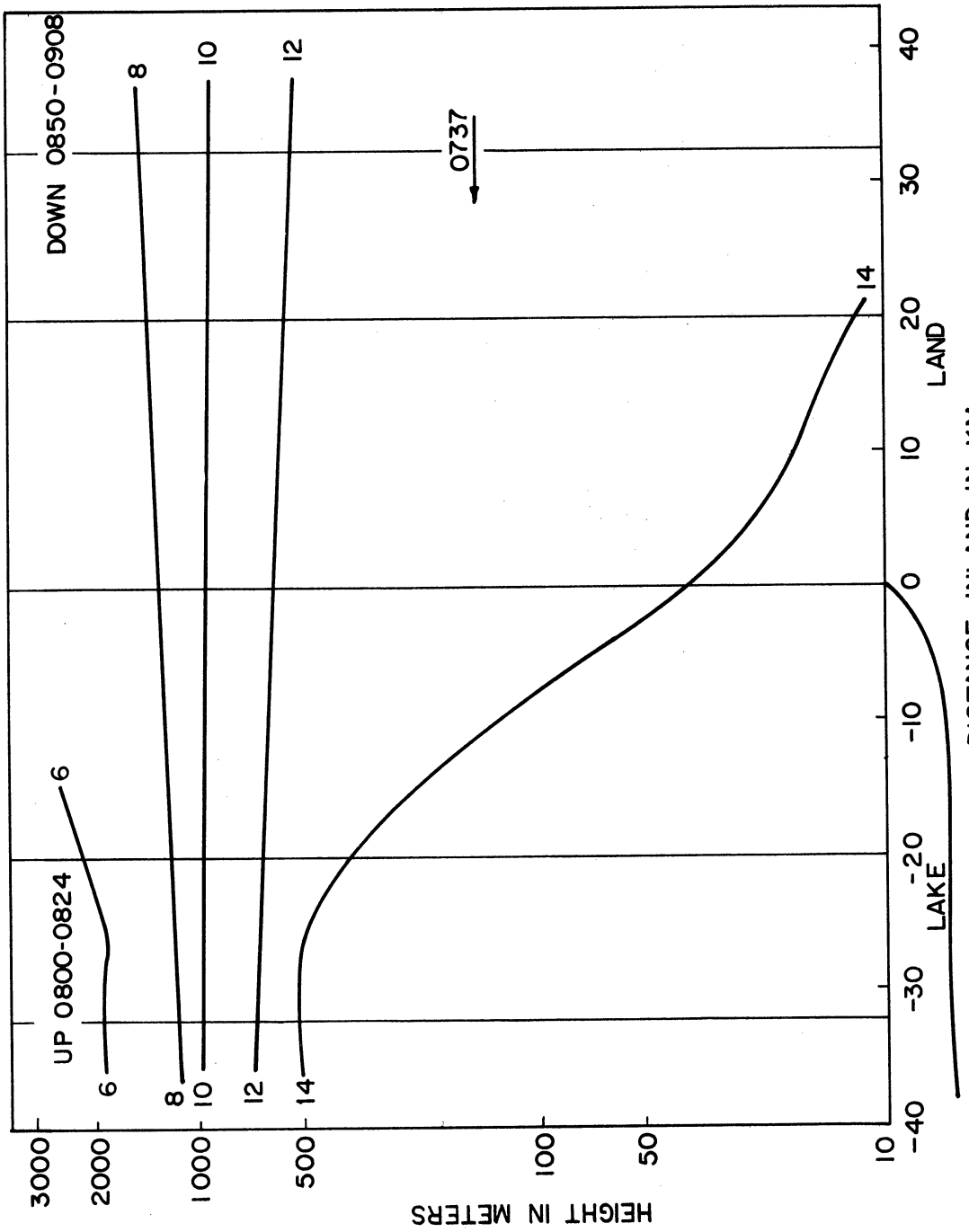

FIGURE 24. Analyzed vertical temperature field in early morning, 0737-0908 EST, 25 June, 1965. Note that a log-scale is used for the ordinate to allow surface and tower data to be illustrated as well as data obtained from further aloft by aircraft.

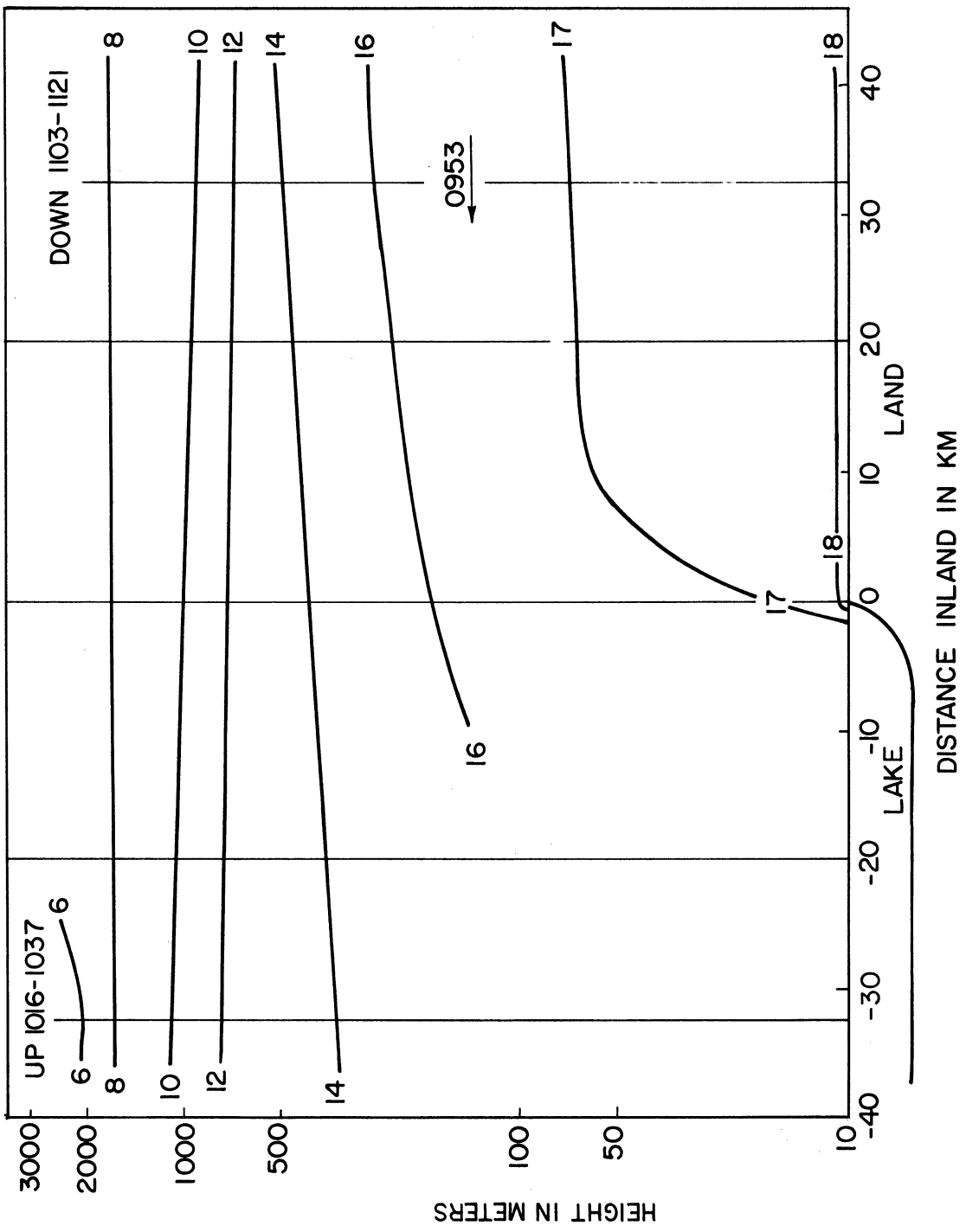

FIGURE 25. Analyzed vertical temperature field in late morning, 0953-1121 EST, 25 June, 1965. Note that a log-scale is used for the ordinate to allow surface and tower data to be illustrated as well as data obtained from further aloft by aircraft.

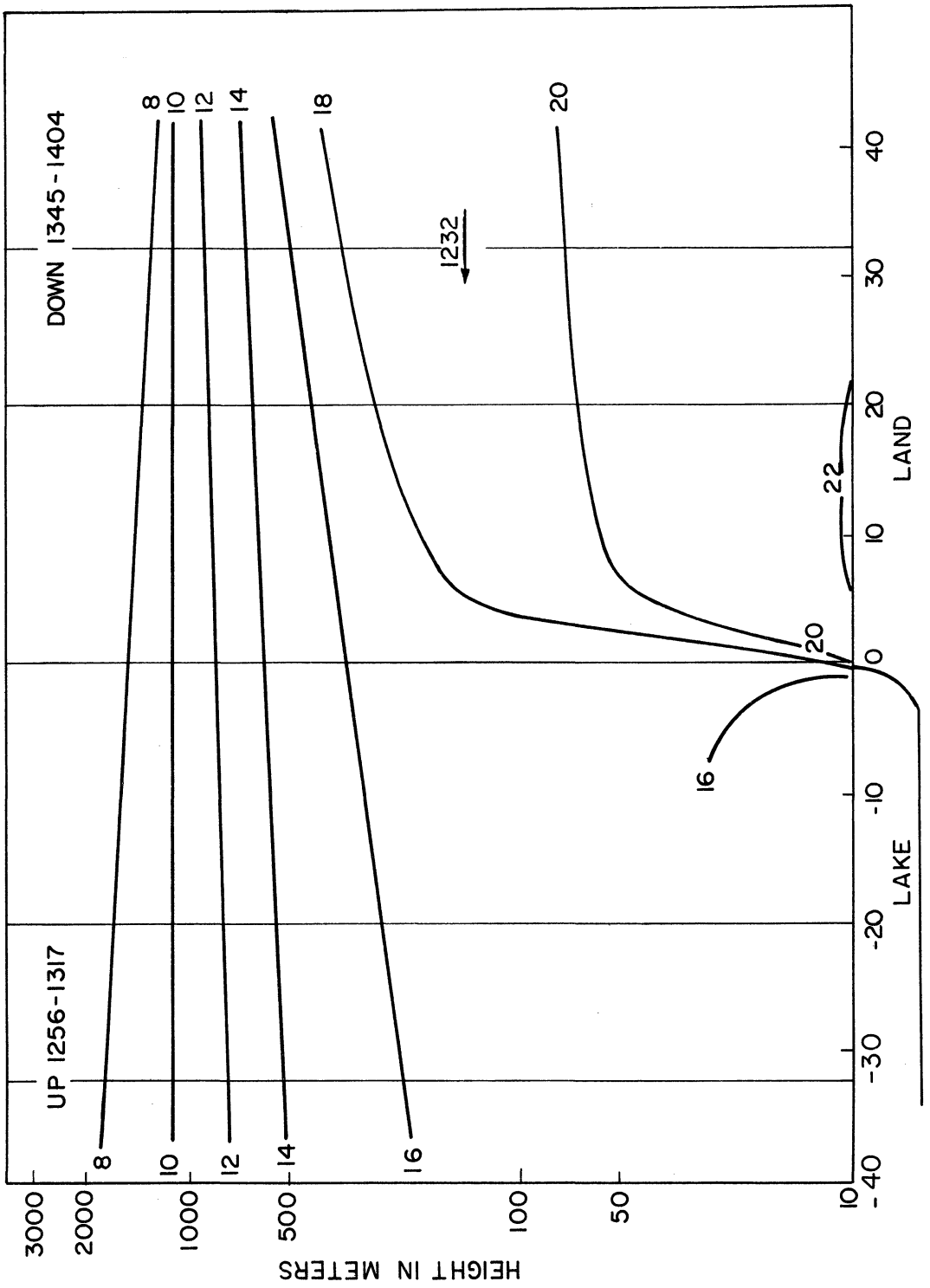

FIGURE 26. Analyzed vertical temperature field in early afternoon, 1232-1404 EST, 25 June, 1965. Note that a log-scale is used for the ordinate to allow surface and tower data to be illustrated as well as data obtained from further aloft by aircraft.

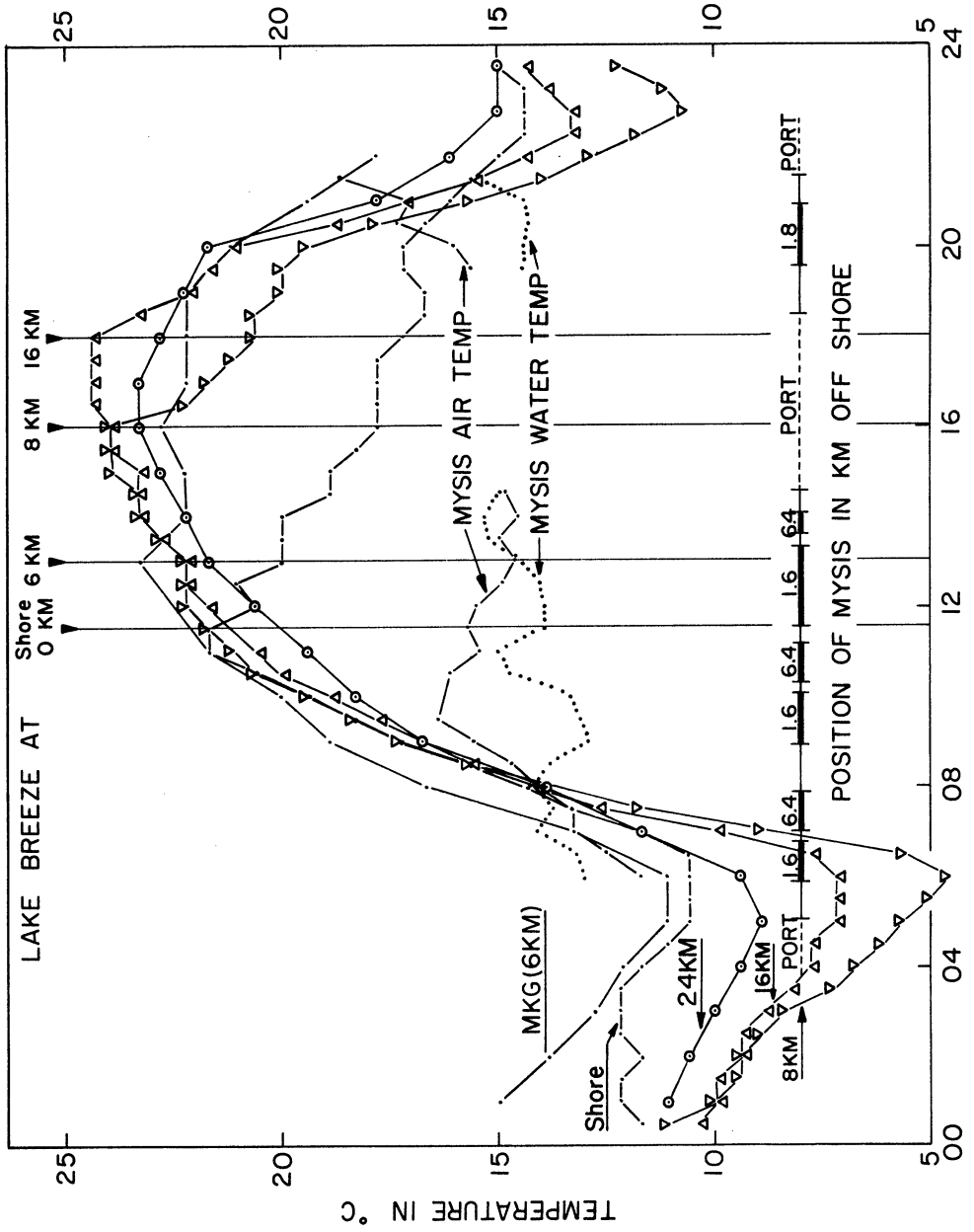

FIGURE 27. Temperature as a function of time at various stations and various distances from shore on 25 June, 1965. Included are air and water temperatures measured from the MYSIS at indicated distances off shore. Air temperatures onboard the MYSIS were sensed 11.8 m above the lake surface while the water temperatures were sensed 1.2 m below the lake surface.

The data are tabulated in Table A1. The "heating curve" for the 24 km station agrees within $\pm$ 1°C with the one observed at GRR, 53 km inland, indicating that the lake breeze never penetrated as far as 24 km. The "heating curve" measured at the 2.4 m level at WJBL, 10 km inland, is in close agreement with the one observed for the 8 km station. Local environmental differences seemed to effect the night-time values of temperature at the stations; however, the daily heating before lake breeze penetration was similar at all stations. When the cold lake air was brought inland by the lake breeze and reached a station, a definite drop in temperature was observed. The times at which the lake breeze reached the various stations are indicated with vertical lines in the figure. Changes in the air temperature over the lake indicate, that before approximately 0900 EST air was flowing off land, reaching at least 1.6 km off shore. Similarily, in the evening the onset of a land breeze was noted. Comparison of air and water temperatures recorded onboard MYSIS with those air temperatures recorded elsewhere suggests the existence of a dome of cold and stable air near the water surface.

It should be noted that the water temperature was varying with time of day and distance from shore, the "day heating" observed being approximately 1.5°C both at 1.6 and 6.4 km off shore, while the water was on the average 1°- 2°C warmer at 6.4 than at 1.6 km off shore.

Although the difficulties in obtaining accurate measurements of moisture parameters are well recognized some analyses of the moisture structure was attempted. The dew point temperature as a function of time at various stations is plotted in Figure 28 and tabulated in Table A1. As the colder and more humid lake air moved inland with the lake breeze, sudden increases in dew point temperature were observed at a station. The time of lake breeze penetration determined by "dew point increase" is in excellent agreement with the time determined on the basis of "temperature drop". Dry bulb temperatures and, to a lesser degree, dew point temperature observed at the inland stations and compared with observations at the lake shore and onboard the MYSIS indicate intense modification of the lake air in a short trajectory over land.

Due to a lack of confidence regarding the time constant and accuracy of the airplane moisture measurements, no vertical cross section of moisture structure is presented.

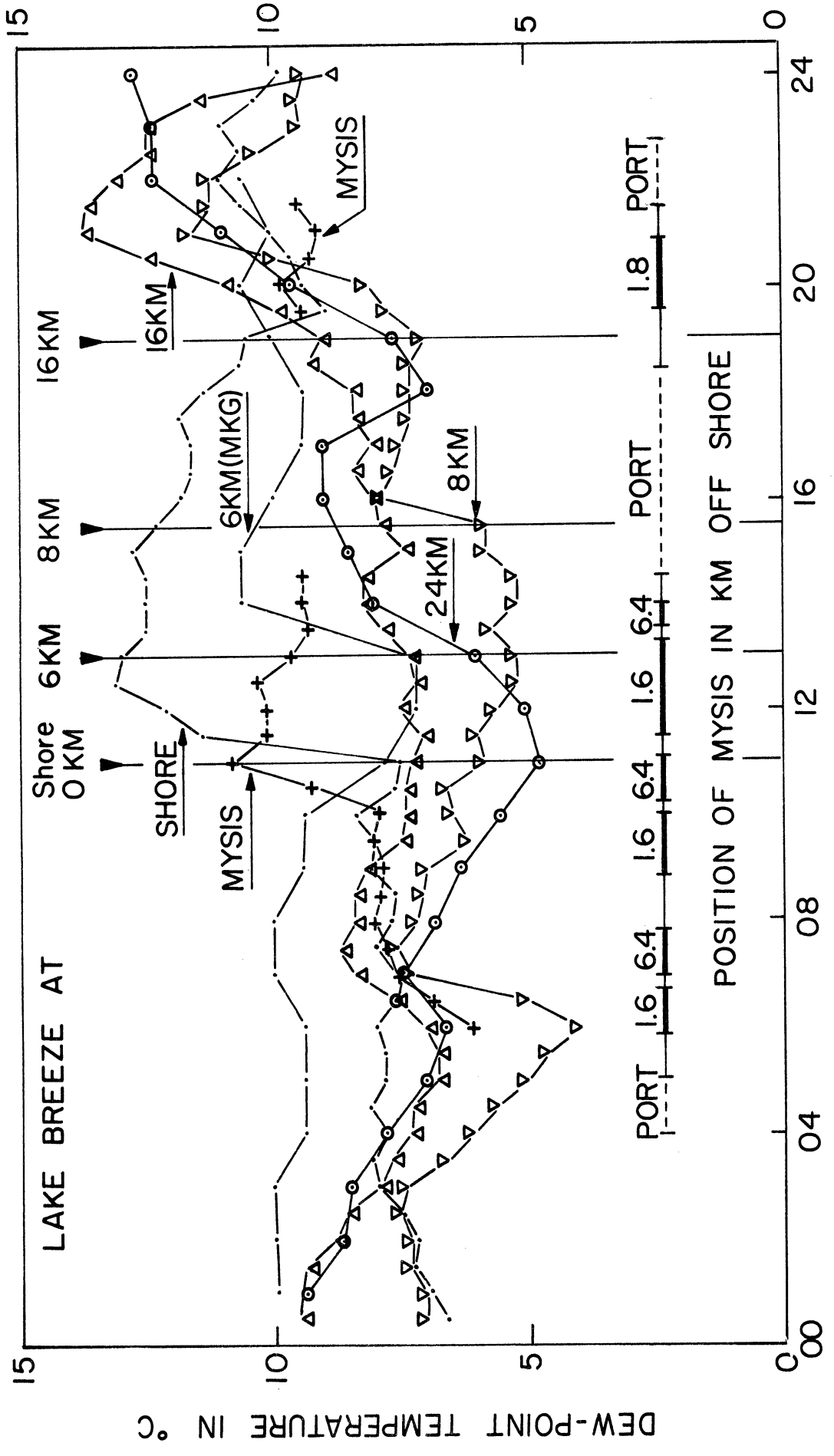

FIGURE 28. Dew Point temperature as a function of time at various stations and various distances from shore on 25 June, 1965. Included are dew point temperatures measured from the MYSIS at indicated distances off shore. The sensor onboard the MYSIS was located 5.0 m above the lake surface.

4.2 THE LAKE AND LAND BREEZE CIRCULATION

The extensive measurements of the circulation, that were made along the observation line and elsewhere in the neighborhood of that line, are presented in tabular form in Tables A4 and A5. In addition to the total wind (VT) and the wind direction (WD), the across-shore component (U), positive inland along the positive x-direction, the along-shore component (V), positive toward the north along the positive y-axis and in the cases of double theodolite tracking, the vertical wind (W), positive upward along the positive z-axis are given. Isotachs for the U and V components are analysed for 0830,1100, 1400, 1700 and 1900 EST and presented in Figures 29-38. In order that the details near the surface could be included, a logarithmic vertical scale is used. Vertical profiles of the U-component at various times and at the various stations are presented in Figure 39.

Figure 40 presents temporal variations of the wind in the land, lake, land breeze circulation at various stations. The black arrows indicate surface, or near surface winds, the red arrows indicate the 200 m winds and the blue arrows indicate 1050 m winds. The maximum lake breeze, an onshore

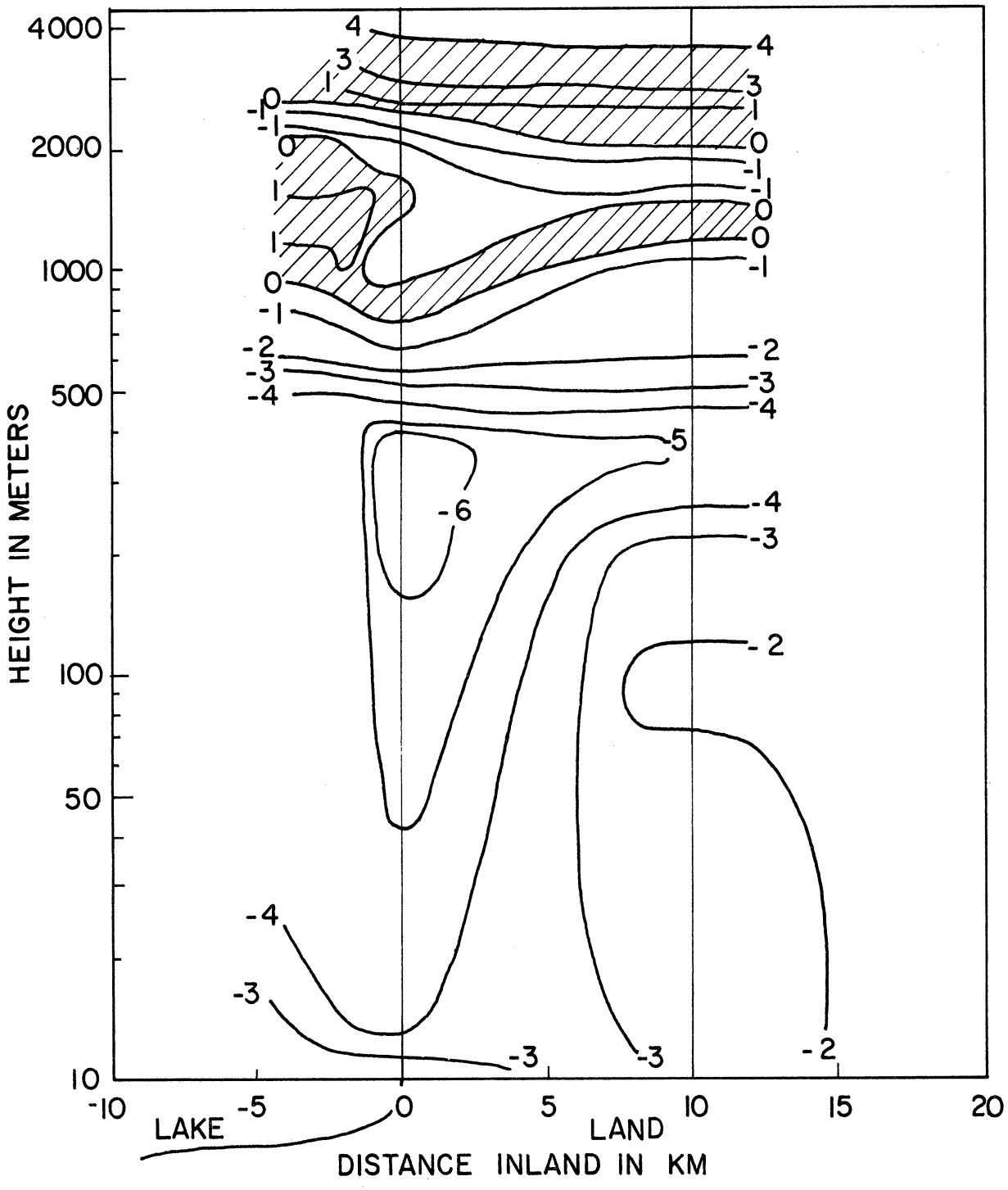

FIGURE 29. Isotachs for the across-shore component (U) at 0830 EST, 25 June, 1965. Positive values, hatched areas, indicate westerly winds (onshore) and negative areas indicate easterly winds (off shore). Wind speeds are in m sec^{-1}.

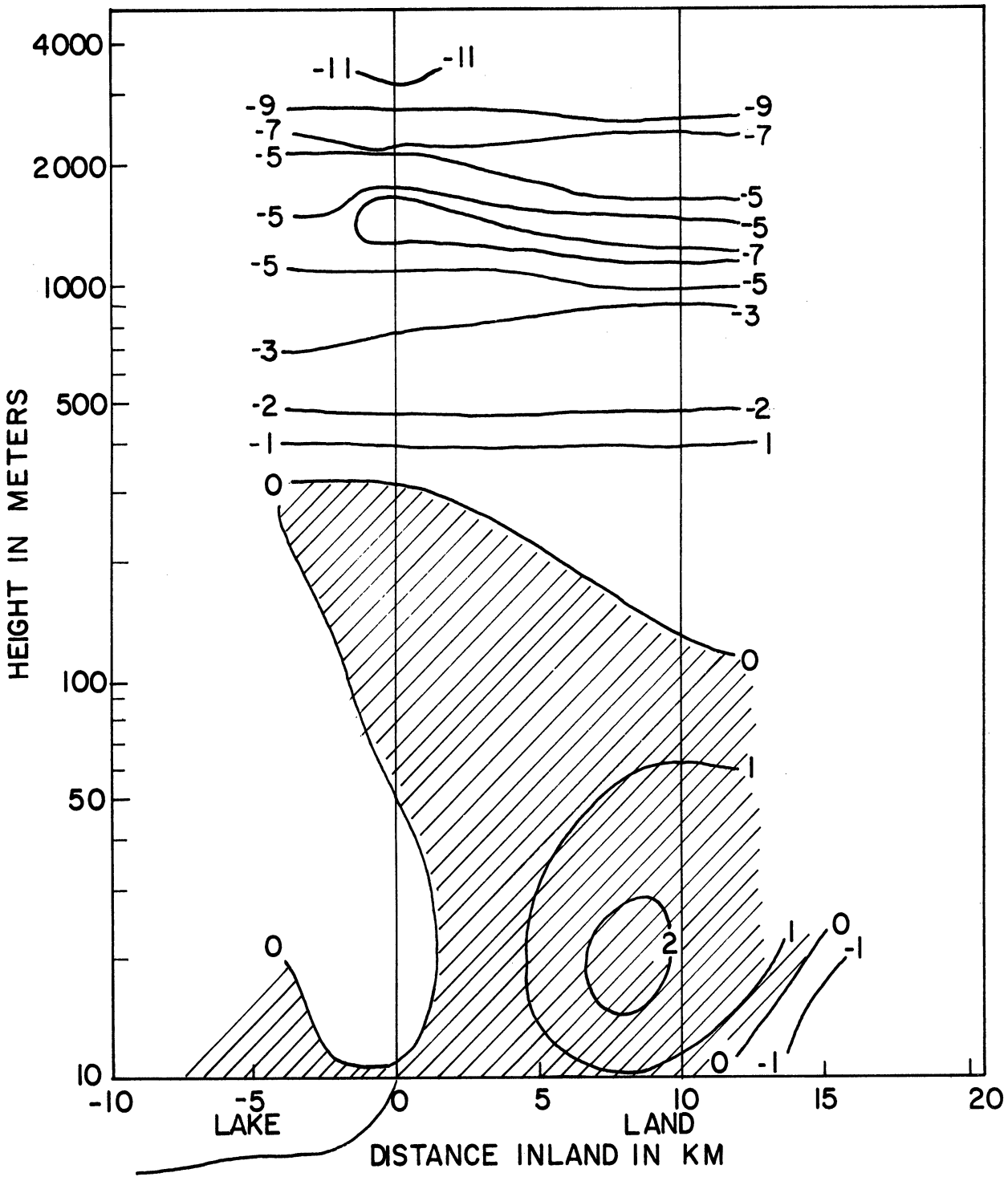

FIGURE 30. Isotachs for the along-shore component (V) at 0830 EST, 25 June, 1965. Positive values, hatched areas, indicate southerly winds and negative values indicate northerly winds. Wind speeds are in m sec^{-1}.

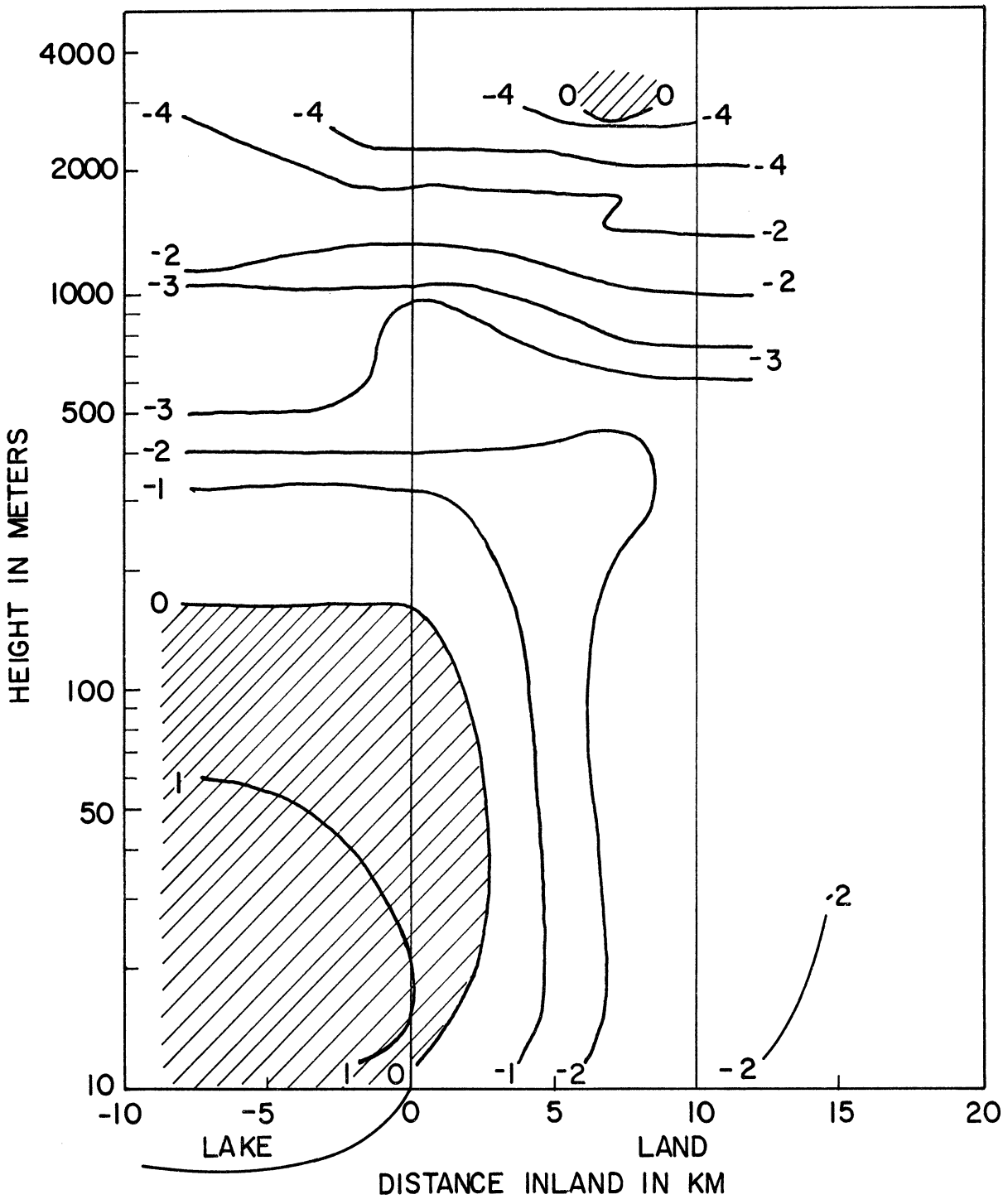

FIGURE 31. Isotachs for the across-shore component (U) at 1100 EST, 25 June, 1965. Positive values, hatched areas, indicate westerly winds (onshore) and negative values indicate easterly winds (offshore). Wind speeds are in m sec^{-1}.

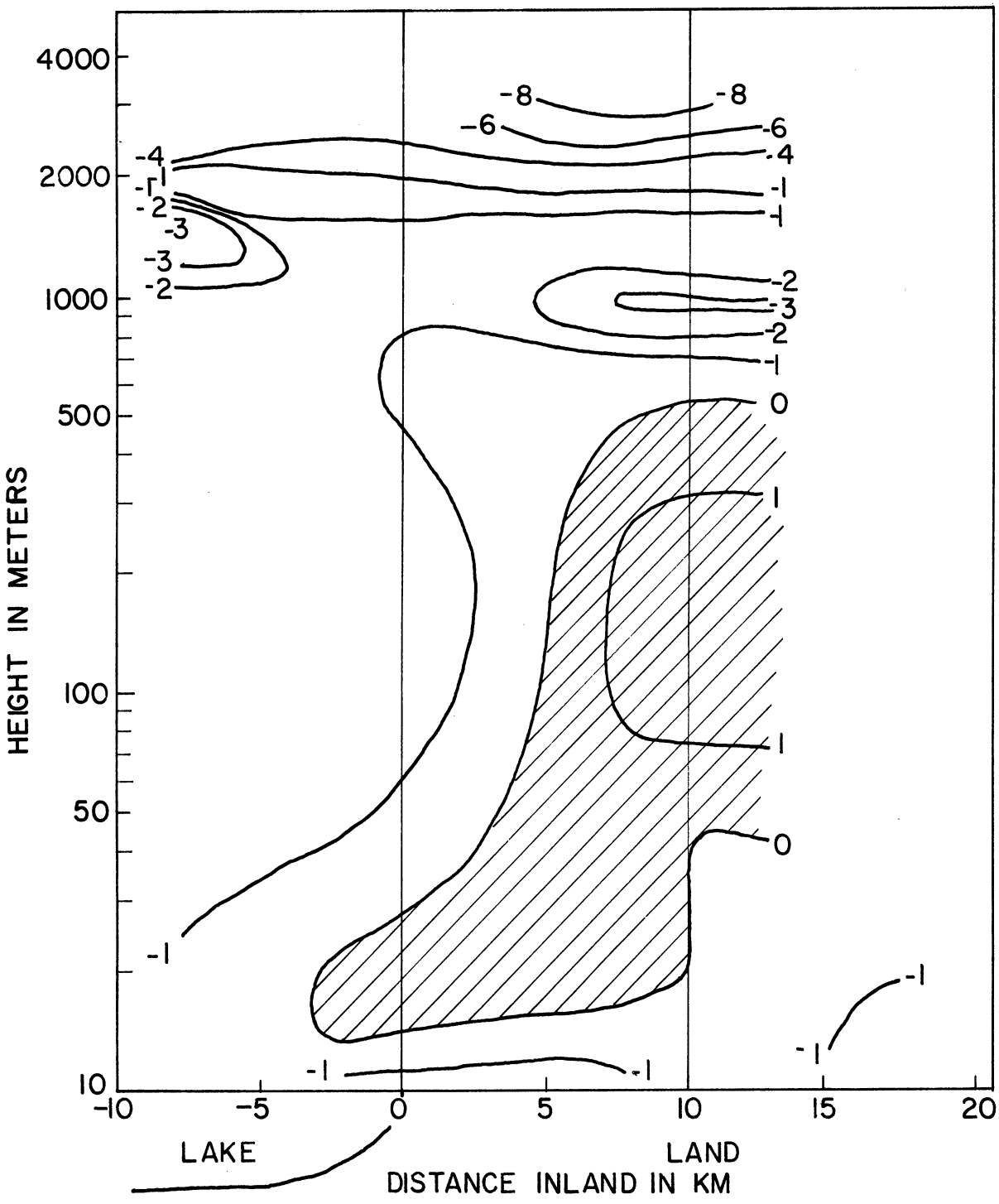

FIGURE 32. Isotachs for the along-shore component (V) at 1100 EST, 25 June, 1965. Positive values, hatched areas, indicate southerly winds and negative values indicates northerly winds. Wind speeds are in m sec^{-1}.

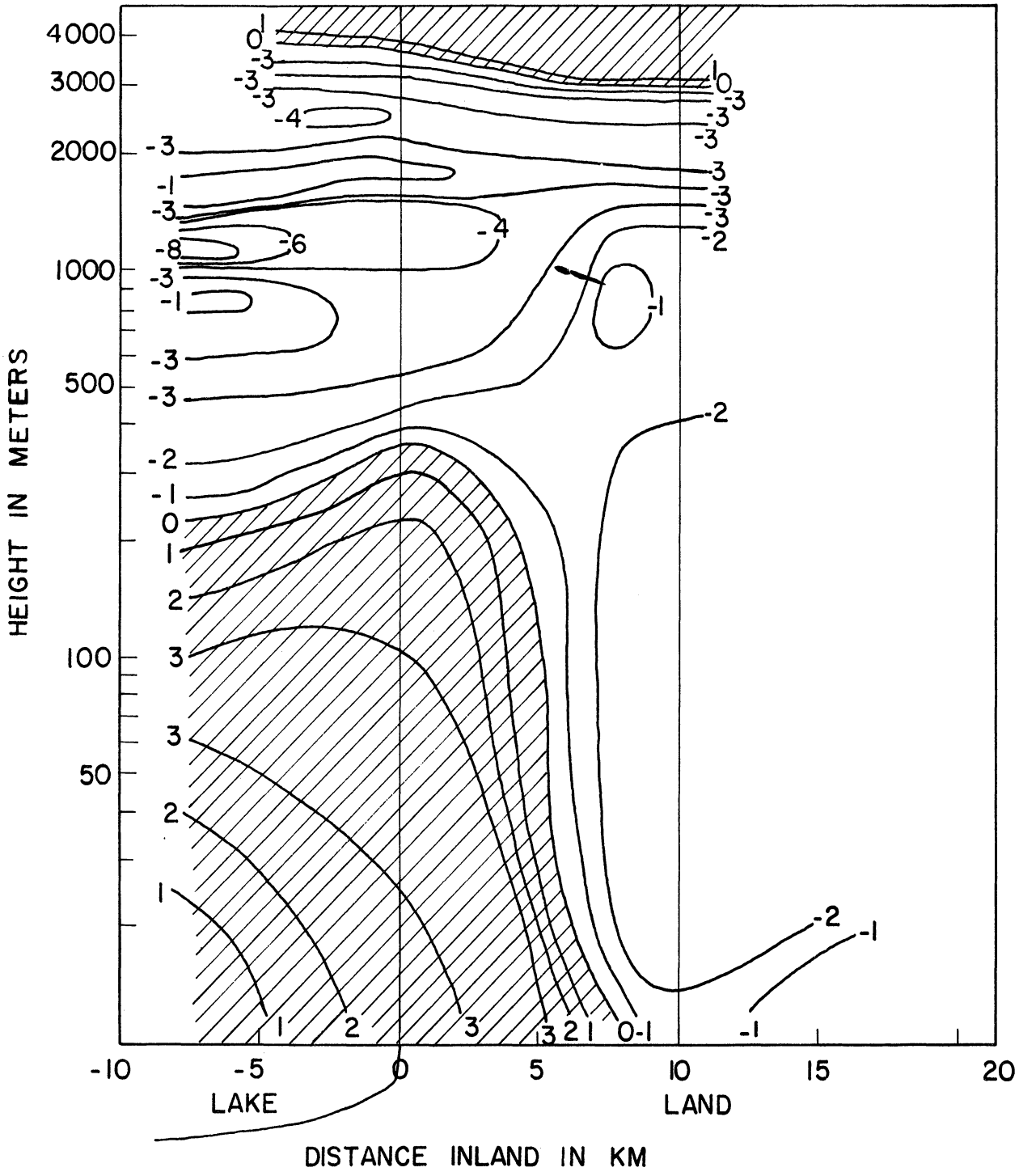

FIGURE 33. Isotachs for across-shore component (U) at 1400 EST, 25 June, 1965. Positive values, hatched areas, indicate westerly winds (onshore) and negative values indicate easterly winds (offshore). Wind speeds are in m sec^{-1}.

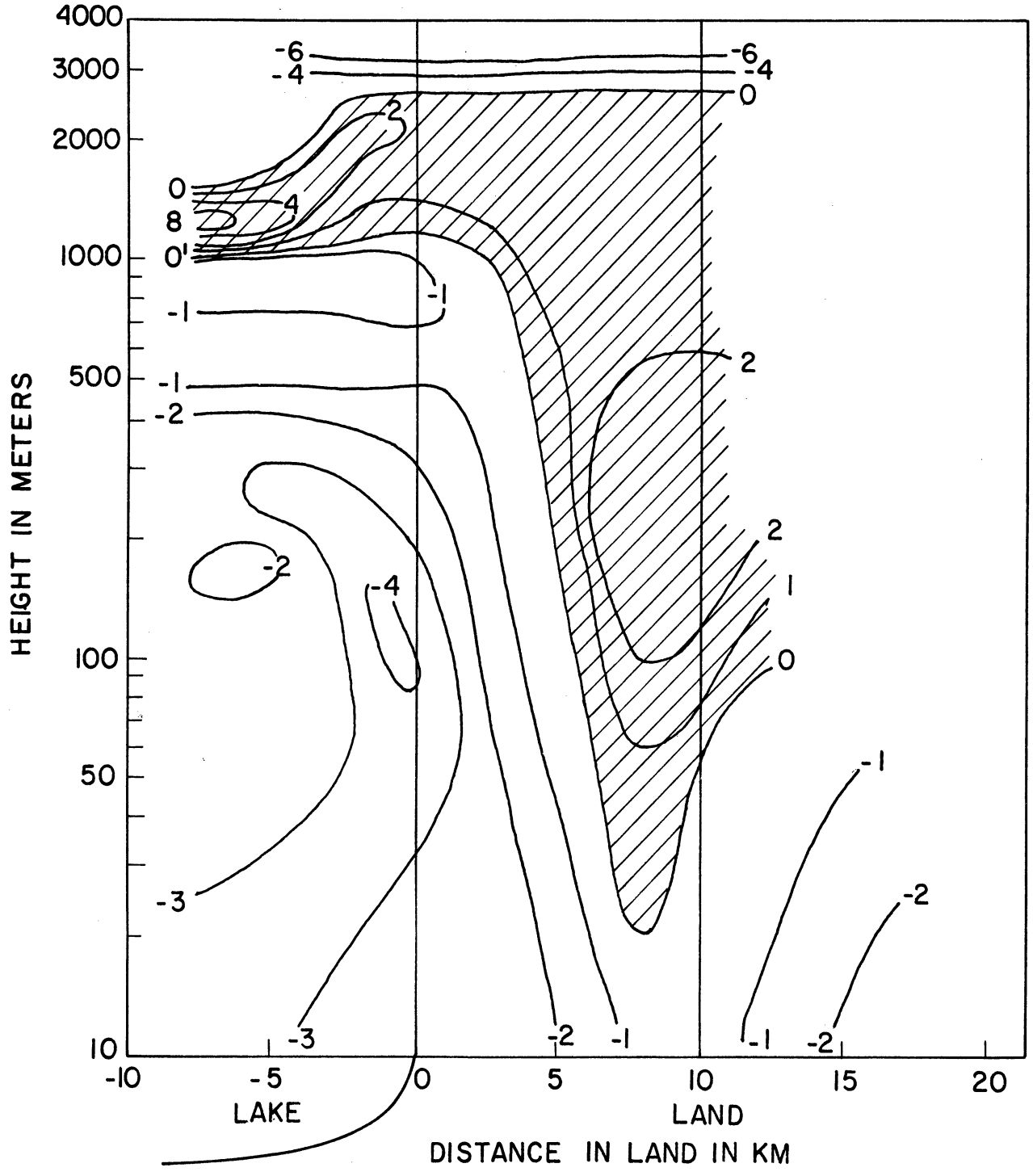

FIGURE 34. Isotachs for the along-shore component (V) at 1400 EST, 25 June, 1965. Positive values, hatched areas, indicate southerly winds and negative values indicate northerly winds. Wind speeds are in m sec^{-1}.

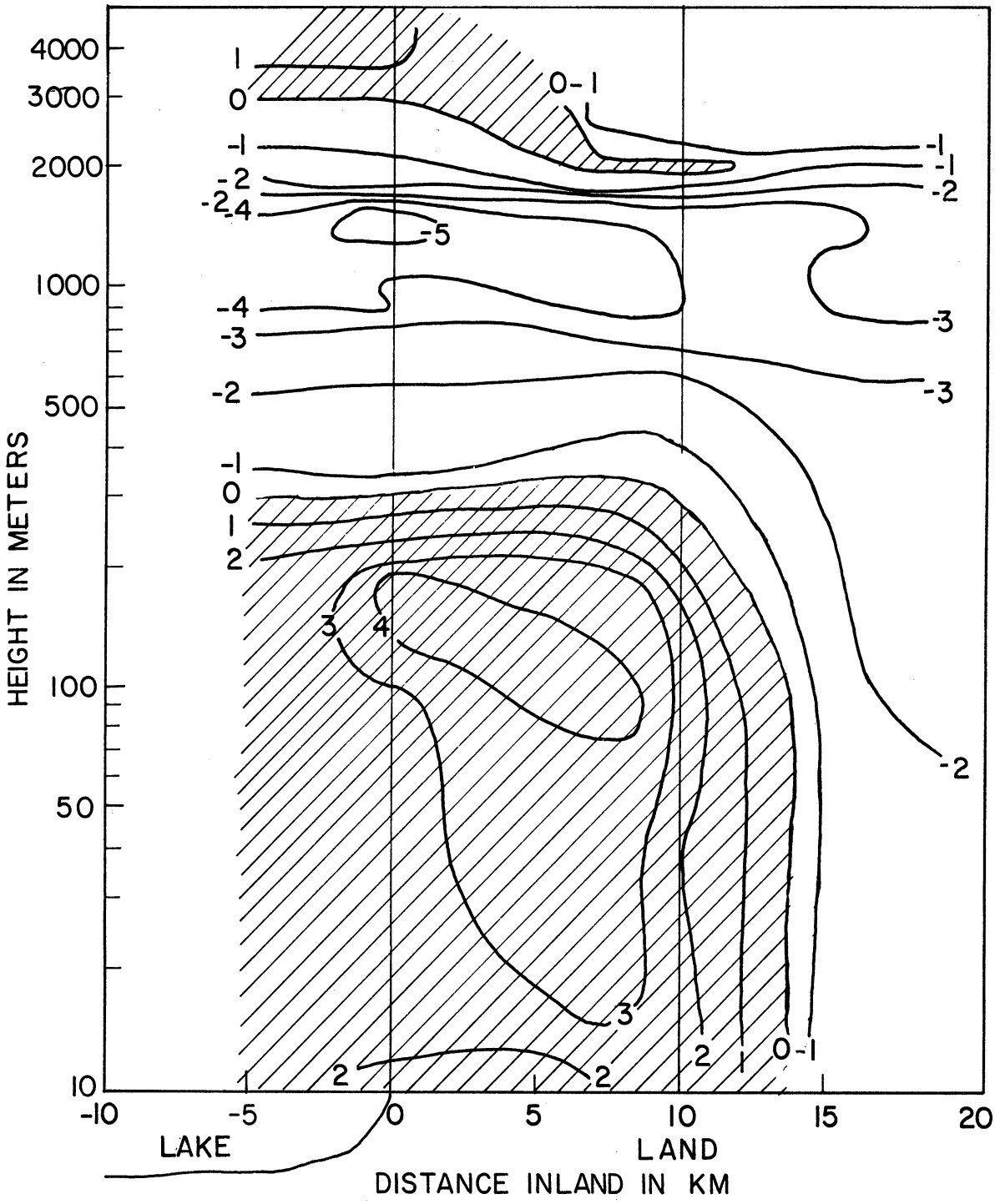

FIGURE 35. Isotachs for the across-shore component (U) at 1700 EST, 25 June, 1965. Positive values, hatched areas, indicate westerly winds (onshore) and negative values indicate easterly winds (offshore). Wind speeds are in m sec^{-1}.

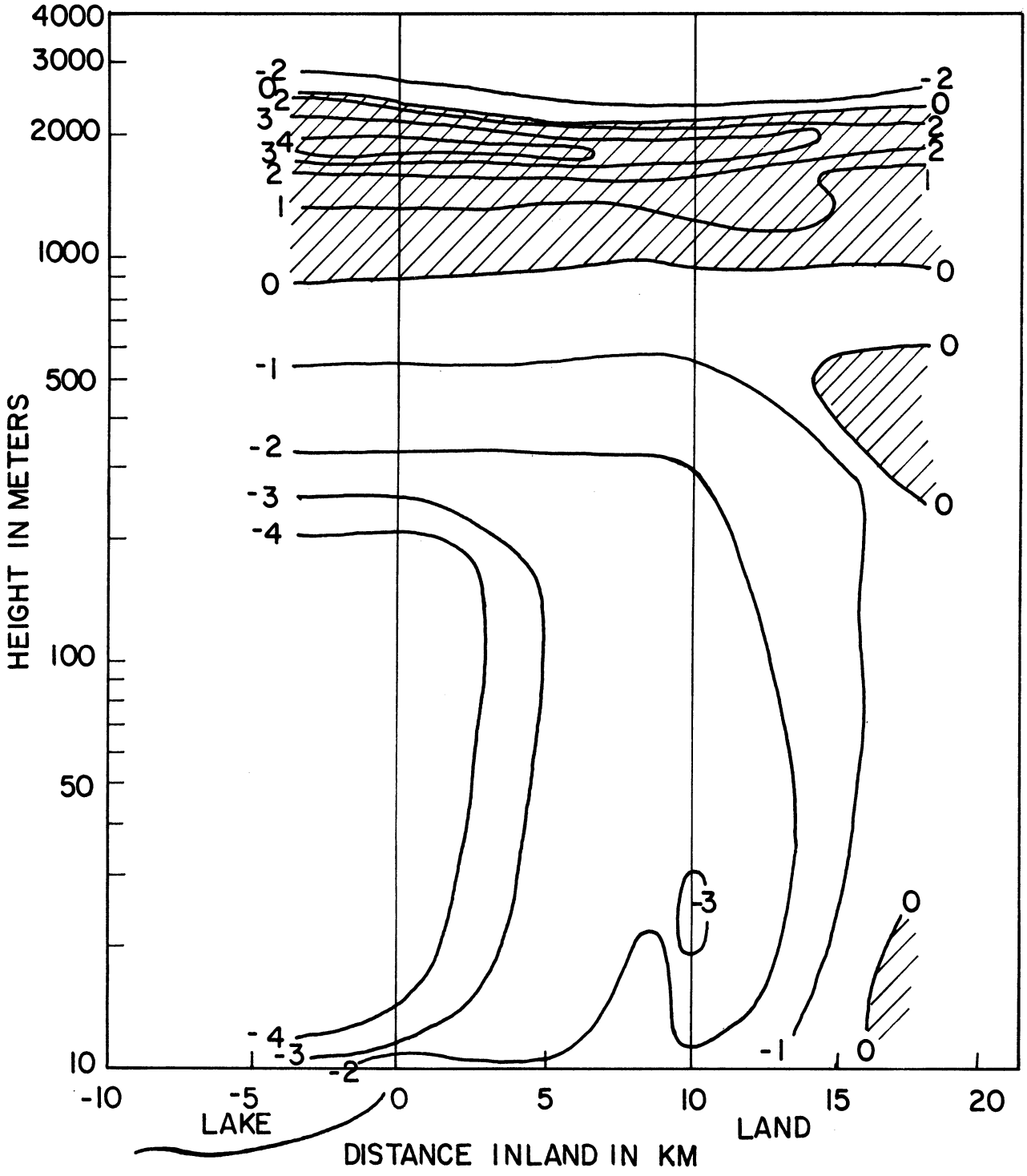

FIGURE 36. Isotachs for the along-shore component (V) at 1700 EST, 25 June, 1965. Positive values, hatched areas, indicate southerly winds and negative values indicate northerly winds. Wind speeds are in m sec^{-1}.

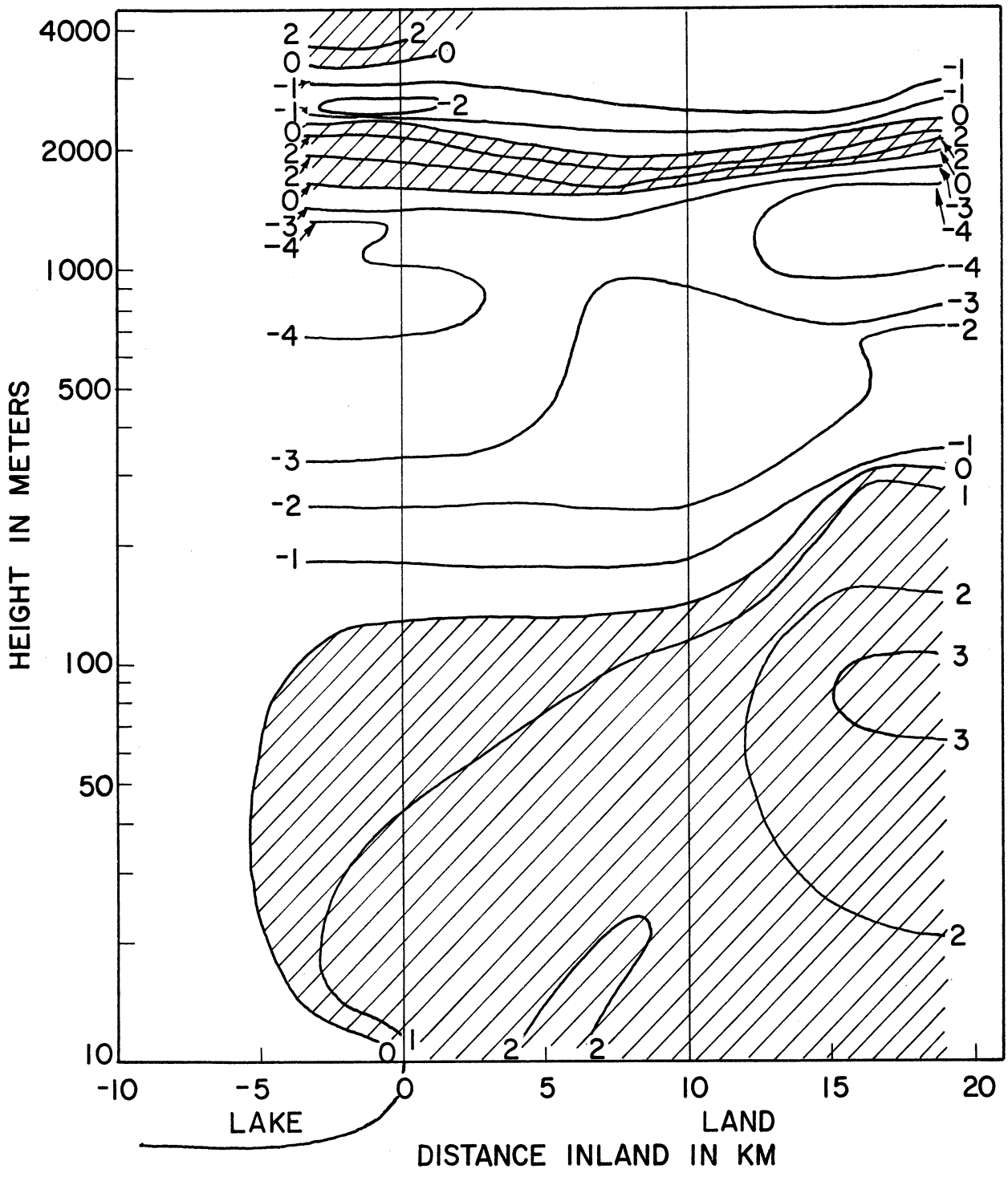

FIGURE 37. Isotachs for the across-shore component (U) at 1900 EST, 25 June, 1965. Positive values, hatched areas, indicate westerly winds (onshore) and negative values indicate easterly winds (offshore). Wind speeds in m sec^{-1}.

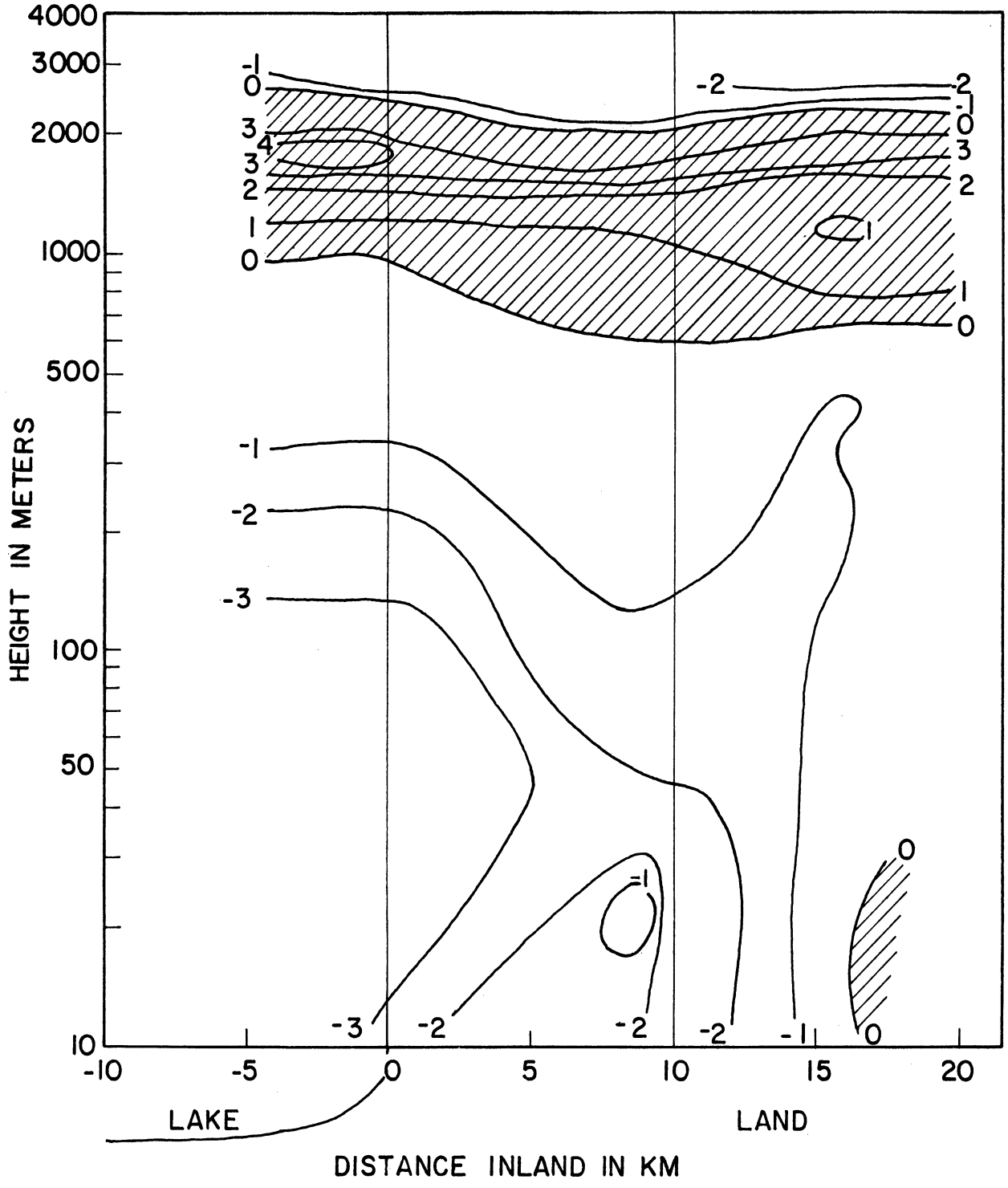

FIGURE 38. Isotachs for the along-shore component (V) at 1900 EST, 25 June, 1965. Positive values, hatched area, indicate southerly winds and negative values indicate northly winds. Wind speeds are in m sec^{-1}.

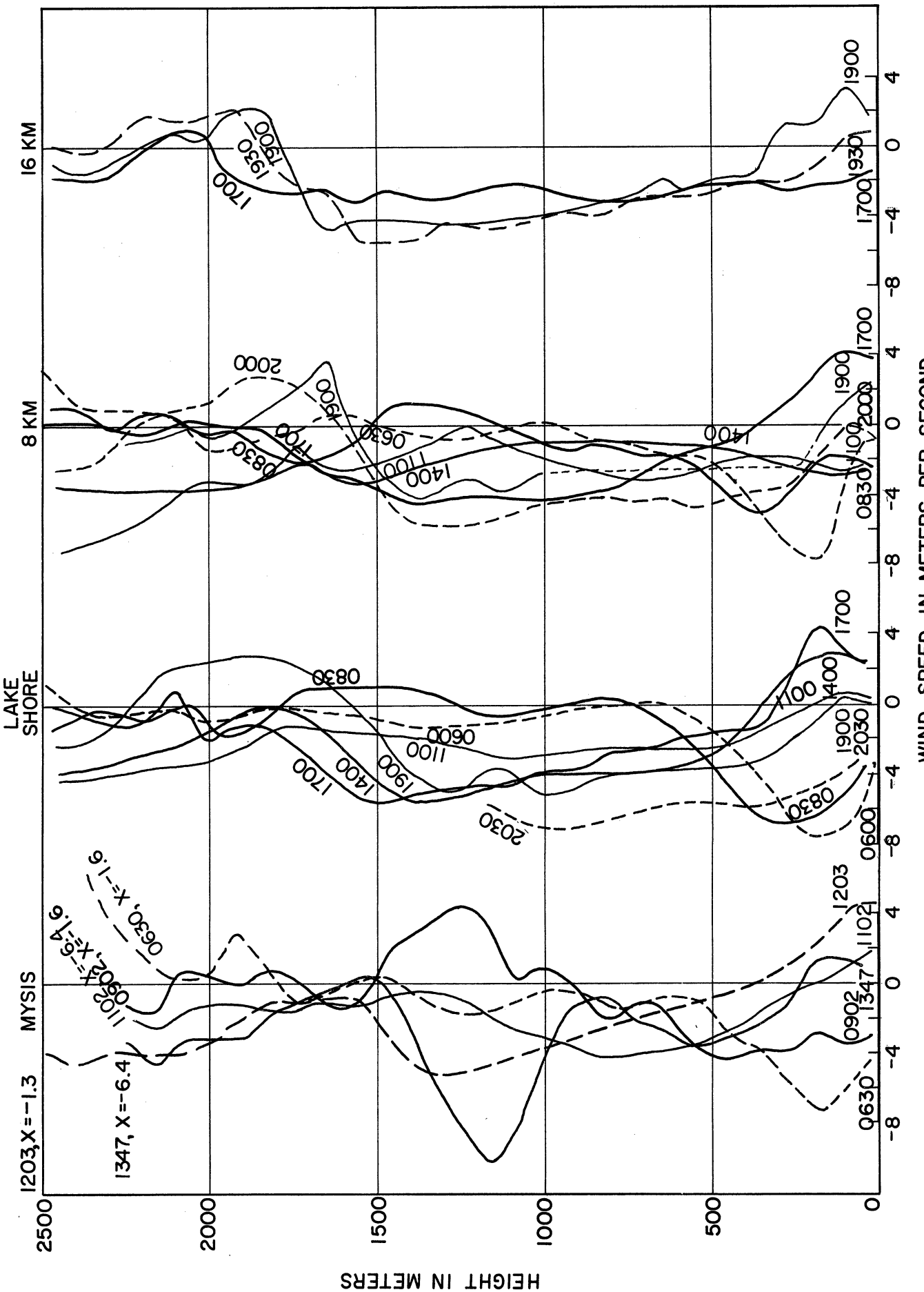

FIGURE 39. Across shore wind component (U) as a function of height at various times and stations, 25 June, 1965. Times given in figure are EST and x-values given for MYSIS indicate the distance off shore in km.

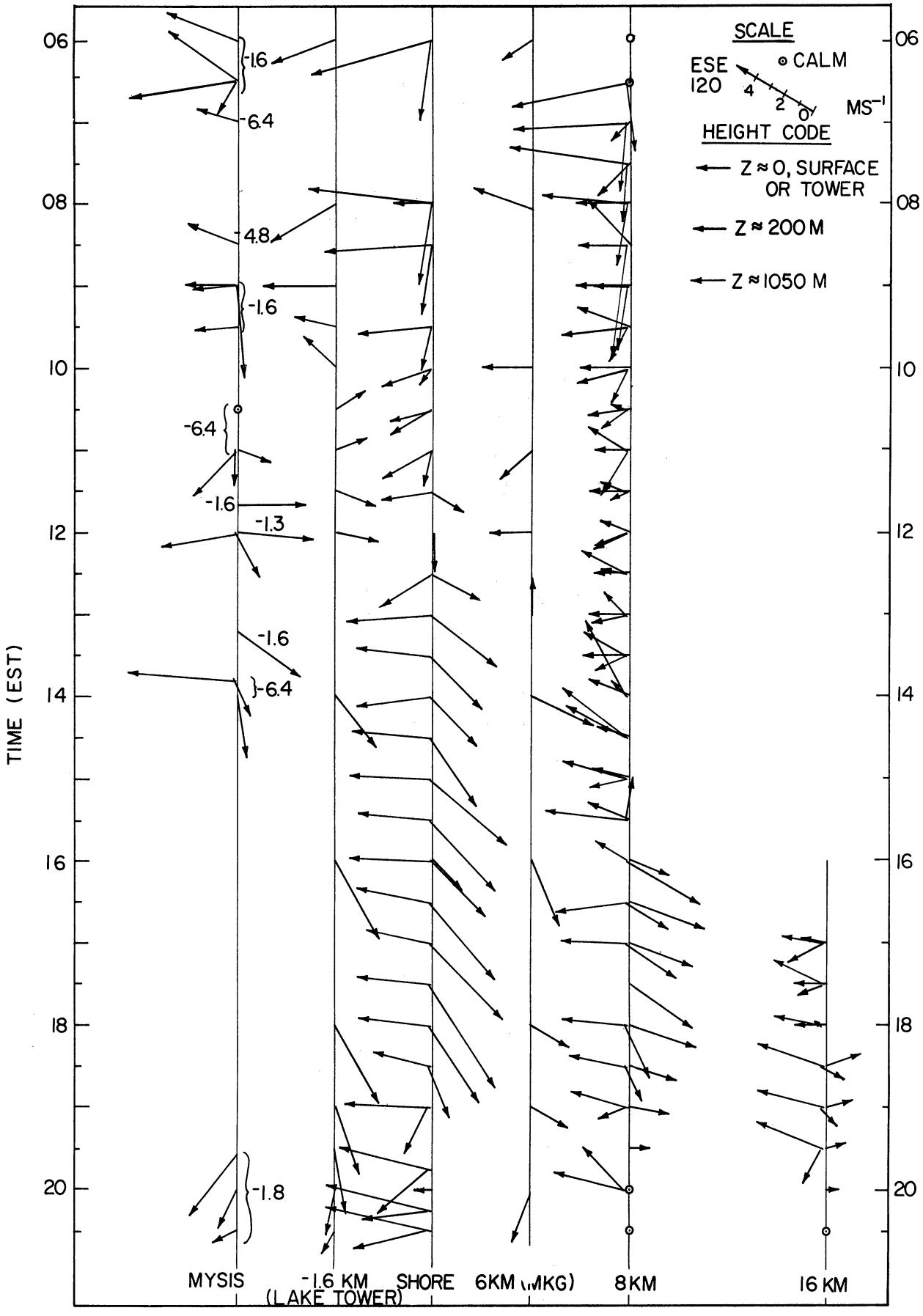

FIGURE 40. Wind vectors at the surface, 200 m and 1050 m aloft at various times and at various stations, 25 June, 1965. Number beside MYSIS' vector indicate distance off shore in km.

wind, and the maximum land breeze, an offshore wind were observed, at about 200 m. The 1050 m level was chosen to be representative of the return flow, the offshore wind aloft in the lake breeze circulation. There was some indication of a return flow associated with the land breeze circulation, in this case an onshore wind aloft with a maximum in a layer above 1200 m; thus not truly represented in Figure 40.

The data tabulated in the appendices contain information that has been left out in the graphical presentation, and has been included only partly in the verbal description of the circulation. As can be seen from Table 1, winds aloft data are available for every 30 minutes near the shore between 0600 EST and 2030 EST. A total of 62 pibal measurements were made and half of these observations were by double theodolite technique and analyzed for vertical velocities as well as for horizontal winds.

The low level land breeze observed at all stations in the morning was reversed to a lake breeze at various times during the day and then again reversed to a land breeze in the early evening. The times for reversal to a lake breeze are in close agreement with the times at which the lake breeze could be

detected at the respective stations, on the basis of temperature and dew point changes, Table 2.

Between 0600 EST and 0700 EST a maximum land breeze was measured at the 8 km station, at the shore and from the MYSIS stationed 1.6 km off shore. A maximum wind of 8 m sec^{-1} was observed at 180 m and the depth of the offshore flow layer was more than 1000 m. There was some indication of a return flow layer, or at least of a return flow effect above the land breeze. Below 400 m, at the shore, subsidence with a maximum downward velocity of 21 cm sec^{-1} at 265 m was observed. Upward velocities were found between 400 m and 2000 m, with a maximum of 82 cm sec^{-1} at 1700 m and a secondary maximum of 49 cm sec^{-1} at 560 m.

At 0830 EST the land breeze had a maximum offshore wind component of 6 m sec^{-1} at 300 m at the shore. The depth of the offshore flow layer was still about 1000 m. An onshore flow layer above 1000 m near the shore suggested a return flow in the land breeze circulation. A southerly wind component observed near the surface over land was evidence of a Coriolis effect on the land breeze, while a northerly gradient flow aloft masked any such effect

TABLE 2. Local times for lake breeze frontal passage at various stations as detected in wind direction change, temperature drop and dew point rise near the surface on 25 June, 1965. The time selected is the time when a change began to take place. The value in bracket is the change that was observed in the next half hour in degrees and ^{o}C. For the lake shore the wind change at 200 m is given and for WJBL the wind change at 20 m is given. For MKG and WJBL half the subsequent one hour change is given.

STATION X-distance	MYSIS -6.4 km	LAKE TOWER -1.6 km	LAKE SHORE 0 km	MKG 6 km	8 KM 8 km	WJBL 10 km	16 KM 16 km
WIND DIR.	1030(200)	1000(130)	1100(90)	1300(65)	1530(180)	1600(110)	1830(160)
TEMPERATURE	1030(0.7)	-	1130(1.1)	1300(0.6)	1600(1.7)	1630(0.9)	1800(1.1)
DEW POINT	1030(1.6)	-	1100(3.9)	1300(1.7)	1530(2.2)	-	1800(0.9)

in the return flow. An average ascent was observed at the shore, with a maximum upward velocity of 97 cm sec^{-1} at 1600 m and a secondary maximum of 37 cm sec^{-1} at 500 m.

Between 0900 EST and 1100 EST strong upward currents were observed near the shore in the lower 1000 m. A maximum of 262 cm sec^{-1} was measured at 1000 EST at 455 m and an average upward velocity below 1000 m between 1000 EST and 1100 EST of 146 cm sec^{-1}, was observed.

At 0900 EST an onshore wind component of 1.4 m sec^{-1} was observed at 1280 m 2.4 km off shore. At 1100 EST an offshore wind exceeding 0.7 m sec^{-1} was observed at that level 7.4 km off shore and at 1200 EST the wind at 1250 m at 2 km off shore had increased to 5.3 m sec^{-1} and with an off shore direction. Closer to shore the wind had an onshore component at 0930 EST in a layer between 1250 m and 1650 m. At 1000 EST the wind in that layer had an offshore component and at 1100 EST this offshore wind component showed a maximum of 2.1 m sec^{-1} at 1290 m. At 0900 EST the onshore wind component at 7.5 km inland exceeded 1 m sec^{-1} in a layer between 1150 m and 1500 m. At 1100 EST the wind in that layer had a maximum offshore component of 2.3 m sec^{-1} at 1500 m.

Both over land and over water there was a direction change toward more offshore wind in a layer between 500 m and 2500 m between 0900 EST and 1100 EST. At the surface the land breeze was weakening. At 1030 EST a windshift from land to lake breeze was observed at the Lake tower, 1.6 km off shore, the MYSIS, then at 6.4 km off shore reported calm conditions. At 1100 EST an onshore surface lake breeze was observed 6.4 km off shore. At 1130 EST the lake breeze reached the shore.

A maximum onshore component over the lake of more than 4 m sec^{-1} was observed from MYSIS at noon, near the surface at 1.3 km off shore. The depth of this onshore flow layer was 350 m and a downward velocity in that layer of 25 cm sec^{-1} at 160 m was observed. In the layer between 350 m and 1700 m the air was in general ascending with a maximum of 67 cm sec^{-1} at 865 m.

At 1400 EST the return flow layer had its maximum offshore component of more than 5 m sec^{-1} at 1200 m at the shore and over the lake. The lake breeze had reached 6 km inland, had a maximum onshore wind component of 3 m sec^{-1} and a depth of more than 300 m at the shore. Inland from the

lake breeze front (the convergence zone), the wind was from the south-east. Above the shore a general ascending motion was observed in the lowest 1300 m, with a maximum of 76 cm sec^{-1} at 890 m and a secondary maximum of 28 cm sec^{-1} at 400 m. Near the lake breeze front the upward velocity was 100 cm sec^{-1} at 120 m, with another maximum of 400 cm sec^{-1} at 1350 m. The Coriolis effect was recognized both in the onshore flow and in the return flow of the lake breeze circulation.

At 1700 EST the lake breeze had reached about 12 km inland, had a maximum onshore wind component of more than 4 m sec^{-1} at 100 m over land and a depth of 300 m. A maximum offshore wind component in the return flow of more than 5 m sec^{-1} was observed at 1450 m at the shore. The vertical wind was upward in the lowest 650 m above the 8 km station with a maximum of 55 cm sec^{-1} at 500 m, and had a strong downward component of 88 cm sec^{-1} at 750 m. The Coriolis effect was again apparent, giving a northwesterly lake breeze flow and an overriding southeasterly return flow.

At 1900 EST the lake breeze was "dying" near the shore leaving only a 3 m sec^{-1} northerly component at the surface. At 16 km

the wind was still off the lake with a speed of 3.2 m sec^{-1} at 90 m. The wind at 1000 m was from the east, with a speed of more than 5 m sec^{-1}. The vertical velocity was in general negative in the lowest 1200 m, with a maximum downward motion of 170 cm sec^{-1}, observed at 1200 m above the 8 km station. Only in the first 100 m was a slight upward motion of less than 25 cm sec^{-1} observed.

Between 1930 EST and 2100 EST the lake shore station as well as both the inland stations and the off shore station showed a reversal to a land breeze near the surface. At 2030 EST both the 8 km and the 16 km stations showed calm. There was some evidence of a return flow associated with the onset of the land breeze circulation in a layer between 1600 m and 2400 m.

It should be noted that upward vertical velocities exceeding 100 cm sec^{-1} were commonly observed near the lake breeze front in the lower 1100 m where maximum values exceeded 200 cm sec^{-1}. Before the arrival of the front at the 8 km station, the flow was very unstable with vertical velocity variations between +100 cm sec^{-1} and -100 cm sec^{-1} in the lower 1000 m. After the passage of the lake breeze front the flow seemed to stabilize.

Both at the shore and at the 8 km station the vertical velocities were upward in the lake breeze onshore flow, but in general less than 50 cm sec^{-1}. Above the lake breeze, in the return flow layer, the vertical velocities at the 8 km station indicated convergence at about 700 m, while at the shore a general ascent, with upward motions exceeding 70 cm sec^{-1} was observed up to 4000 m. Observational errors gave some extreme values, but vertical velocities of about 400 cm sec^{-1} appear to be real. A general subsidence, with downward velocities of less than 30 cm sec^{-1} was observed in the lower 1000 m in the evening, after the reversal from lake to land breeze.

Qualitative observations, i.e. traces of recorded winds and temperatures, indicated that the lake breeze front penetrated inland in a series of pulses with a period of less than 2 hours.

4.3 SUMMARY

The spatial and temporal variations of temperature, moisture and wind near the eastern shore of Lake Michigan have been observed and described for 25 June, 1965. During this day a weak northerly gradient flow prevailed and a well developed lake breeze occurred. In summary the observations show:

1. The effect of the differential heating between land and lake surfaces led to a strong horizontal temperature gradient near the surface exceeding $1.2^{o}C\ km^{-1}$ ($6^{o}C/5$ km) across the shore in the afternoon;

2. The temperature of the air over land became equal to the temperature of the air over the water and also to the lake water temperature between 0700 EST and 0800 EST and again between 2000 EST and 2100 EST;

3. Air over the lake remained relatively stable throughout the day in the lowest 600 m. Intense modification of this air in short trajectories over land was observed. Intense vertical mixing led to adiabatic and even superadiabatic conditions over land

in the afternoon. Strong nocturnal inversion over land in the lowest 80 m was observed. Isothermal conditions in that layer occured at about 0730 EST and 2030 EST;

4. An offshore flow aloft, the return flow, was observed at the shore in a layer between 500 m and 2000 m between 0800 EST and 1100 EST. This observation was the first indication of a lake breeze circulation;

5. The onset of an onshore flow, the lake breeze, was observed near the surface over the lake and at the shore between 1100 EST and 1130 EST;

6. While the return flow, once established, seemed to be steady, qualitative observations indicated that the lake breeze penetrated inland in a series of pulses with a period of less than 2 hours;

7. Strong vertical upward motion exceeding 200 cm sec^{-1}, coupled with low level horizontal convergence, occurred near the lake breeze front, the

lakeward sloping surface between the advancing cooler air off the lake, and the heated air over land. Air temperature drops of more than $1^{\circ}C$, dew point increases exceeding $3^{\circ}C$, and reversal of surface winds occurred within one hour, as the lake breeze front passed. These changes were less pronounced the further inland the front penetrated;

8. The maximum depth of the layer of onshore flow was 400 m near the lake breeze front in the late afternoon;

9. The maximum onshore wind of more than 4 m sec^{-1} occurred in a layer 100-200 m aloft, immediately inland from the shore in the late afternoon;

10. Upward motion, in general less than 50 cm sec^{-1}, was observed in the lake breeze flow layer over land. Downward motion was observed in that layer 1.2 km off shore;

11. The return flow layer aloft was more than 2000 m thick at the shore, with a maximum offshore wind component in excess of 5 m sec^{-1}

at 1200 m in the late afternoon;

12. The vertical velocity varied from +70 cm sec^{-1} to -70 cm sec^{-1} in the return flow layer. Several vertical convergence layers were observed with the most pronounced at about 700 m near the lake breeze front;

13. The effect of the Coriolis force was pronounced in the onshore flow at about 200 m, but also noted in the return flow aloft. In the afternoon the return flow was from the east-south-east and sandwiched between a northwesterly low level onshore flow and a weak northerly gradient flow above 2500 m;

14. The maximum inland penetration of the lake breeze front was approximately 20 km, occurring in the early evening, when the low level winds near and off the shore already had reversed to a land breeze;

15. Although no definitive criteria were found to determine the depth of penetration of the lake breeze circulation into the atmosphere,

there were indications of influence in the flow pattern up to and above 4000 m in the afternoon;

16. A low level offshore flow, the land breeze, was observed in the morning and again in the evening;

17. The depth of the land breeze was more than 600 m and its strongest offshore wind component of 7 m sec^{-1} was observed both over land and over the lake at 200 m between 0600 EST and 0700 EST;

18. There was some evidence of a return flow associated with the land breeze circulation in a layer between 1200 m and 2400 m;

19. The effect of Coriolis force was observed in the land breeze circulation and was most pronounced in the lower layer of the land breeze. It was masked aloft by the gradient flow;

20. Shoreline downwash and upwash effects, caused by changes in roughness between land and lake surfaces were

apparent, i.e. the air in the land breeze layer descended as it moved across the shore and out over the lake, while the air in the lake breeze layer ascended at the shore-line, before any thermal instability was expected to have been induced in the layer;

21. Temporal and spacial variations of the water temperature in response to solar heating and dynamic air-sea interaction exceeded $3^{o}C$;

22. A mesoscale "lake high" developed during the day in response to the low level divergence and the sub-sidence over the lake and reached maximum intensity of more than 4 millibars in the early evening;

23. Surface wind data from stations around the lake suggested that the lake effect was homogenous along the lake shore.

5. A COMPREHENSIVE SUMMARY OF PREVIOUSLY REPORTED OBSERVATIONAL STUDIES OF LAND, LAKE, AND SEA BREEZE CIRCULATIONS.

The observations presented in the previous section constitute, to the authors knowledge, the most extensive measurements of a land-lake breeze circulation. It is evident that differences in the synoptic situation and coastal characteristics would influence observed circulations. The observations reported by Moroz (1965, 1967) under similar synoptic situations and at the same location are indeed in very close agreement with those reported here. His observations showed that the onshore flow in the lake breeze circulation, in general, had a depth of less than 600 m and that a maximum onshore velocity of more than 4 m sec^{-1} occurred within 250 m of the surface immediately inland from the shore. Furthermore the return flow layer aloft was more than 1500 m thick and a maximum offshore velocity exceeding 3 m sec^{-1} occurred in the afternoon at 1200 m at the shore. The depth of the offshore flow, the land breeze, seemed to exceed 1500 m at 0900 EST on 23 July 1964, and would have obscured the onset of the return flow in the late morning; there was, however, an

increase in the offshore velocity at 900 m at the shore between 0900 EST and 1100 EST. The lake breeze onshore component was first observed at the shore at 1100 EST. At 0745 EST on 10 July 1963, Moroz observed a weak land breeze in the lowest 200 m 5 km off shore with indications of an overriding return flow in the land breeze circulation. Later that day at 1710 EST he observed a 2 m sec^{-1} lake breeze in the lowest 200 m and an overriding return flow at more than 16 km off shore. The effects of Coriolis force were clearly evident both in the onshore and in the offshore component of the lake breeze circulation. Moroz found the lake breeze front to penetrate inland in a pulsating manner and that the lake air was modified after short trajectories over land.

Observations reported by Strong (1968) were made on the western shore of Lake Michigan under essentially non-zero gradient wind conditions. Strong used single theodolite tracking of pibals in determining horizontal wind fields aloft. He calculated horizontal divergence and was thus able to evaluate vertical velocities. Upward velocities of more than 60 cm sec^{-1} were estimated 2.2 km inland and downward velocities exceeding

60 cm sec^{-1} were found in the vicinity of 800-1000 m at 2.2 km off shore.

Lyons (1966, 1967) reported on lake breezes in the southern basin of Lake Michigan. He evaluated satellite cloud photos and compared them with cloud and smoke photos taken from the surface and from an airplane. A ring of towering cumulus associated with the lake breeze front was observed around the lake, suggesting along-shore homogenity in the lake breeze circulation around the lake. The tops of these convective clouds were observed to be carried toward the lake in the return flow above the lake breeze and to dissipate near the lake shore. Lyons suggested that this dissipation was due to an increased stability in the lower layer, the lake breeze layer, over the lake and near the lake shore, thus a decreased convection coupled with a gravity type wave motion causing intense subsidence in the return flow layer. Subsidence over the lake was observed as smoke was carried off shore by the return flow aloft and was also evident from the lack of clouds over the lake itself. Chagnon (1967) and Lansing (1965) reported on average precipitation over the lake

and showed it to be considerably less than over adjacent land areas. Lansing (1965) observed average temperatures over land to be more than 1°C higher than over water during summer months. Average maximum temperatures were about 4°C higher. Lyons observed lake effects in cloud layers 5000 m aloft. He also reported on meteorological observations made in the Chicago, Ill., area. He also observed lake breezes to penetrate more than 60 km inland and the depth of the lake breeze to be approximately 300 m. At one time on 7 June 1963, the air temperature inland was more than 15°C higher than at the shore. The onshore wind component of the lake breeze was in general less than 5 m sec^{-1}. It should be noted that the urban heat island effect and increased surface roughness has to be considered in the evaluation of these observations.

Strong and Bellaire (1967) observed the onset of the lake breeze to be at the lakeshore and a subsequent growth of the lake breeze circulation cell both lakeward and landward. Hall (1954) summarized the synoptic conditions under which a lake breeze penetration 12 km inland, to Chicago Midway Airport occurred. He stated that, if the gradient wind is less than 7 m sec^{-1} with an along shore or offshore direction, the cloudiness is less than 6 tenths

and the air temperature is more than 5°C above the lake water temperature one could expect the lake breeze front to reach the airport in the afternoon. Reduced visibility at the airport could be expected, as the smoke filled convergence zone, the lake breeze front, reaches the airport. He also indicated the occurrence of a lake high developing on lake breeze days. Defant (1951) gave an example from the Baltic sea, where the afternoon pressure on twenty sea breeze days averaged 0.8 mb higher on a lightship than at a land station.

Hewson et al (1961, 1963) measured the natural ventilation on the western shore of Lake Erie and on the eastern shore of Lake Michigan. They found lake and land breezes to be frequent in the summer half of the year. Shallow lake breeze inversions were observed near the shore in the onshore flow. The depth of these inversion layers were less than 50 m and the inversions were found to be destroyed within 3 km from the lake shore.

Munn and Richard (1964) observed land and lake breeze circulations on the eastern shore of Lake Huron under light gradient winds. They found the depth of the stable onshore flow layer to be less than 200 m at the shore and a new internal boundary layer to develop

over land in response to land heating. The depth of that superadiabatic layer was between 30 and 60 m at 300 m from the lake. The lake breeze was observed at the shore at about 0900 EST when a 180° wind shift and a 3°C temperature drop occurred. At about 1600 EST the lake breeze front was observed as a wind shift at 19 km inland. The temperature drop was more gradual and indicated intense modification of the air as it passed over land. Munn and Richards stated that this modification sometimes is so strong that the lake breeze disappears completely, permitting a new lake breeze front to form and move inland.

Sea breeze observations reported by Fisher (1960), and by Frizzola and Fisher (1963) were made under essentially non-zero gradient wind conditions on the coast of New England. They found that the onshore flow of the sea breeze circulation had a depth of less than 1000 m at the shore and that the maximum onshore velocity occurred below 300 m near the shore in the afternoon. They also found that the depth of the onshore flow was greater when onshore gradient flow existed than with offshore gradient flow. The sea breeze front was more pronounced in offshore gradient flow

cases. The Coriolis effect as well as the return flow layer could be detected but were obscured by overriding gradient flow. Pack and Angell (1963), Angell and Pack (1965) and Hass et al (1967) observed sea breezes by means of tetroons and found that the onset of the onshore flow occurred 9 km off shore at 150 m, approximately an hour before the onset was observed at the shore. Furthermore, they found that the tetroon sometimes traced a small anticyclonic loop over the ocean before being carried inland by the sea breeze.

Wallington (1959, 1965) observed average upward velocities of 250 cm sec^{-1} and occasional updrafts of about 800 cm sec^{-1} in a sea breeze front. The front, sometimes less than 250 m wide was well marked by "curtains of clouds".

Craig et al (1945) gave what has been considered a typical cross section of moisture in the sea breeze circulation. A dry tongue aloft, at about 200 m, over the water has been associated with the return flow aloft and the subsidence off shore. Atlas (1960) observed the sea breeze penetration by means of radar and suggested sharp moisture contrasts across the sea breeze front. He found moisture pick up to occur from the warm waters close to shore and to be most marked in air which had

a previous over land history, e.g. land breeze air.

Eddy (1966) observed the sea breeze to penetrate approximately 40 km inland from the coast of Texas and the land breeze to extend about 15 km off shore. He found evidence of diurnal wind variations at altitudes as high as 5000 m. Dixit and Nicholson (1964) observed the sea breeze near Bombay, India to extend more than 160 km off shore. They found the depth of the onshore flow layer to be less than 1400 m and some evidence of a return flow above that layer.

Wexler (1946) reported on the land breeze over Lake Constance converging toward the center of the lake, with accompaning rising motion which caused stratus to form at about 200 m. This occurred frequently in spring and fall, but seldom in the summer. He also reported that land breeze fronts in the tropics may be locus of nocturnal cumulus and thunderstorms.

Wexler (1946) and Defant (1951) reported that the highest probability for lake (sea) breezes to occur is in the spring and summer, while land breezes are most frequent in the fall. They also reported that along coasts at middle latitudes lake (sea) breezes occur on more than 30% of the days in spring and summer. At higher latitudes the

frequency of occurrence is lower, e.g. at the shore of the Baltic sea, sea breezes are not expected to occur on more than 20% of the days, even in the summer. In the polar regions the phenomenon disappears almost completely. On tropical coasts the land and sea breezes occur almost ever day in the summer months, while they appear on about 30% of the days during the rest of the year.

6. CONCLUSIONS

The "ideal" thermal circulations caused by differential heating and cooling of land and water surfaces are difficult to observe. Local climatological and topographical effects as well as non-zero large scale gradient winds influence the observed land and lake (sea) breeze circulations. The dimensions of these circulations as well as the magnitude of associated wind velocities, wind direction changes, temperature changes and moisture variations vary with latitude and horizontal extent of land and water surfaces.

The reported observations give some guidelines to the search for a better physical understanding of how these circulations are initiated and how they develop.

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APPENDIX

TABULATION OF DATA

TABLE A1. Dry bulb temperature (T) in °C, relative humidity (RH) in %, dew point temperature (T_d) in °C and solar radiation (SR) in cal cm^{-2} min^{-1} for several stations near an observation line south of Grand Haven, Michigan, 25 June, 1965. Subscripts u, L and w in the MYSIS column indicate upper sensor (11.8 m above surface), lower sensor (5.1 m above surface) and water temperature (1.2 m below surface) respective. MYSIS' off shore distance (X) in km is given.

TIME	WJBL 2.5m	LAKE SHORE 0 KM				8 KM			16 KM			24 KM			MYSIS					GRR			MKG			TIME
	T	T	RH	T_d	SR	T	RH	T_d	T	RH	T_d	T	RH	T_d	X	T_U	T_L	T_d	T_W	T	RH	T_d	T	RH	T_d	
0030	9.0	11.7	71	6.6	0.00	11.1	76	7.0	10.6	93	9.5															0030
0100	8.3	12.2	70	6.9	0.00	10.0	82	7.0	10.0	96	9.4	11.1	89	9.4						12.2	83	9.4	15.0	72	10.0	0100
0130	8.0	12.2	72	7.3	0.00	9.4	87	7.3	10.0	96	9.4															0130
0200	7.8	11.7	74	7.2	0.00	9.4	87	7.3	9.4	96	8.8	10.6	88	8.7						12.2		8.9	13.9		10.0	0200
0230	7.5	12.2	73	7.5	0.00	8.9	91	7.5	9.4	95	8.6															0230
0300	8.2	12.2	75	7.9	0.00	8.3	94	7.4	8.9	96	8.3	10.0	89	8.5						10.6		9.4	12.8		10.0	0300
0330	6.9	12.2	76	8.1	0.00	7.2	96	6.6	8.3	96	7.7															0330
0400	5.6	11.7	77	7.8	0.00	6.7	96	6.1	7.8	97	7.3	9.4	90	7.8						10.6	83	7.8	12.2	83	9.4	0400
0430	6.6	11.1	82	8.1	0.00	6.1	96	5.6	7.8	97	7.3															0430
0500	5.7	10.6	83	7.8	0.00	5.6	96	5.0	7.2	97	6.8	8.9	88	7.0						10.0		7.8	11.1		9.4	0500
0530	7.5	10.6	83	7.8	0.01	5.0	96	4.5	7.2	97	6.8															0530
0600	5.5	10.6	84	8.0	0.05	4.4	96	3.9	7.2	98	7.0	9.4	83	6.6	-1.6	11.7	11.5	6.1	13.0	9.4		7.8	11.1		9.4	0600
0630	10.4	10.6	82	7.6	0.30	5.6	96	5.0	7.8	98	7.5				-1.6	12.5	12.3	6.9	13.2							0630
0700	11.5	11.7	75	7.5	0.50	8.9	90	7.3	10.0	90	8.4	11.7	75	7.4	-6.4	13.2	13.2	7.5	14.1	11.1	86	8.9	13.3	80	10.0	0700
0730	12.5	13.3	70	8.0	0.65	11.7	76	7.6	12.8	76	8.7				-6.4	13.2	13.3	7.7	13.7							0730
0800	14.5	14.4	64	7.7	0.78	13.9	64	7.2	14.4	67	8.4	13.9	62	6.8	-6.0	14.2	14.2	8.0	14.2	15.0		10.0	16.7		10.0	0800
0830	16.1	15.6	59	7.6	0.90	15.6	57	7.1	15.6	62	8.4				-4.8	14.7	14.7	7.9	13.8							0830
0900	17.3	17.2	55	8.1	1.02	17.2	51	7.0	16.7	57	8.2	16.7	50	6.3	-1.6	15.6	15.5	7.8	12.9	17.8		10.6	18.9		9.4	0900
0930	18.4	18.3	51	8.0	1.08	18.3	47	6.1	17.8	51	7.5				-1.6	16.4	16.3	8.0	13.1							0930
1000	18.5	19.4	49	8.4	1.14	19.4	43	6.5	18.9	47	7.4	18.3	43	5.5	-1.6	17.0	17.0	7.9	13.3	18.9	97	10.0	20.0	31	9.4	1000
1030	20.7	20.6	43	7.6	1.18	20.6	40	6.6	20.0	44	7.4				-6.4	16.1	16.0	9.2	14.7							1030
1100	20.8	21.7	40	7.5	1.20	21.1	37	5.8	20.6	42	7.3	19.4	38	4.7	-6.4	15.4	15.4	10.8	15.0	20.4		10.6	21.7		7.8	1100
1130	21.5	21.7	52	11.4	1.23	21.7	36	6.0	21.1	40	7.0				-1.6	15.7	15.6	10.1	13.9							1130
1200	21.4	20.6	58	12.1	1.26	22.2	34	5.6	21.7	40	7.5	20.6	36	5.0	-1.6	15.5	15.5	10.1	13.9	20.6		10.0	22.2		7.2	1200
1230	22.4	21.1	60	13.1	1.25	22.2	33	5.2	22.2	38	7.2				-1.6	14.9	15.0	10.3	14.0							1230
1300	22.6	20.0	64	13.0	1.24	22.2	33	5.2	22.2	38	7.2	21.7	36	6.0	-1.6	14.6	14.7	9.6	14.5	21.7	48	10.0	23.3	34	7.2	1300
1330	22.4	20.0	62	12.5	1.22	22.8	33	5.7	22.8	38	7.8				-6.4	15.0	15.0	9.3	15.2							1330
1400	22.8	20.0	62	12.5	1.21	23.3	31	5.2	23.3	38	8.2	22.2	40	8.0	-6.4	14.5	14.6	9.4	15.3	21.7		8.9	22.2		10.6	1400
1430	23.2	18.9	66	12.5	1.15	23.3	31	5.2	23.3	38	8.2				-1.5	14.8	14.6	9.4	14.9							1430
1500	23.0	18.9	67	12.7	1.10	23.9	31	5.8	23.3	36	7.4	22.8	40	8.5						23.3		10.0	22.2		10.6	1500
1530	23.7	18.3	68	12.3	1.00	23.9	31	5.8	23.9	36	7.9															1530
1600	22.1	17.8	68	11.8	0.90	23.9	36	8.0	23.9	36	7.9	23.3	40	9.0						22.8	40	8.3	22.8	44	10.0	1600
1630	22.3	17.8	67	11.6	0.80	22.2	39	7.6	24.4	36	8.4															1630
1700	21.4	17.8	67	11.6	0.70	21.7	40	7.5	24.4	35	8.0	23.3	40	9.0						23.3		7.8	22.2		9.4	1700
1730	21.4	17.8	68	11.8	0.54	21.1	41	7.3	24.4	36	8.4															1730
1800	20.3	17.2	68	11.3	0.42	20.6	42	7.3	24.4	36	8.4	22.8	36	6.9						22.8		8.3	22.2		9.4	1800
1830	20.5	16.7	68	10.6	0.29	20.6	42	7.3	23.3	41	9.3															1830
1900	20.0	16.7	67	10.5	0.16	20.0	43	7.0	22.2	43	9.0	22.2	39	7.6						22.8	38	7.8	22.2	44	10.0	1900
1930	19.6	17.2	58	8.9	0.05	20.0	45	7.7	21.7	47	9.9				-1.8	15.6	15.4	9.4	14.4							1930
2000	19.0	17.2	60	9.4	0.02	19.4	48	8.1	21.1	52	10.9	21.7	46	9.6	-1.8	16.0	15.5	9.8	14.4	21.1		9.4	21.1		10.6	2000
2030	16.8	16.7	63	9.6	0.00	17.8	60	9.9	18.9	66	12.4				-1.8	17.3	16.0	9.2	14.3							2030
2100	13.9	16.1	67	10.0	0.00	15.6	77	11.6	17.2	80	13.7	17.8	64	10.9	-1.8	17.0	16.4	9.1	14.4	18.3		10.6	19.4		10.0	2100
2130	13.6	15.6	72	10.6	0.00	13.9	84	11.2	15.6	88	13.6				-0.5	18.6	17.8	9.5	15.5							2130
2200	14.2	15.0	77	11.0	0.00	12.8	90	11.2	14.4	92	13.1	16.1	78	12.3						16.7	67	10.6	17.8	63	10.6	2200
2230	12.3	14.4	78	10.6	0.00	11.7	91	10.3	13.3	94	12.4															2230
2300	13.0	14.4	80	11.0	0.00	10.6	92	9.4	13.3	94	12.4	15.0	84	12.3												2300
2330	13.4	14.4	76	10.3	0.00	11.1	90	9.5	13.9	85	11.4															2330
2400	14.2	15.0	71	9.8	0.00	12.2	80	8.9	14.4	69	8.8	15.0	86	12.7												2400

TABLE A2. Air and soil temperatures in °C at various heights respective depths at the WJBL station north of Holland, Michigan, 25 June, 1965.

	Height Above Ground in M								
TIME	-1.00	-0.10	-0.01	2.4	4.9	9.8	19.5	39.0	78.0
0030	15.5	15.8	20.1	9.0	9.9	11.5	12.7	13.9	14.4
0100	15.3	19.4	15.5	8.3	9.8	10.9	12.2	13.5	15.1
0130	15.5	19.2	15.4	8.0	8.6	11.0	12.2	13.6	14.9
0200	15.2	18.7	14.6	7.8	8.5	10.1	12.0	13.1	14.2
0230	15.4	18.6	14.5	7.5	8.5	10.2	11.5	13.2	13.9
0300	15.1	17.9	13.9	8.2	8.5	9.0	10.1	11.6	12.8
0330	15.4	18.0	13.8	6.9	7.5	8.9	10.6	11.9	13.1
0400	15.2	17.4	13.3	5.6	6.7	8.5	10.6	12.5	12.6
0430	15.4	17.3	13.0	6.6	6.9	7.5	10.6	12.1	13.1
0500	15.2	16.6	12.5	5.7	6.8	8.5	9.9	11.8	12.2
0530	15.5	16.6	12.4	7.5	8.0	9.0	9.5	11.0	12.0
0600	15.1	16.0	12.0	5.5	6.5	8.0	9.9	10.9	11.2
0630	15.5	16.1	12.1	10.4	10.0	10.3	10.6	11.4	12.3
0700	15.2	15.5	13.0	11.5	11.5	11.5	11.2	11.0	11.9
0730	15.4	15.5	13.6	12.5	12.8	12.8	12.4	12.3	12.0
0800	15.4	15.5	15.0	14.5	14.7	14.4	13.8	13.5	13.4
0830	15.9	15.9	17.5	16.1	15.9	15.6	15.4	15.0	14.5
0900	15.5	15.9	19.4	17.3	17.4	16.5	16.0	16.0	15.4
0930	16.0	16.5	22.5	18.4	18.0	17.5	17.4	16.7	16.4
1000	15.5	17.0	25.0	18.5	18.2	17.6	17.5	17.4	16.6
1030	16.0	17.6	27.6	20.7	19.8	19.7	19.0	18.5	17.9
1100	15.5	18.0	29.8	20.8	19.9	19.0	18.2	18.0	17.6
1130	16.1	19.0	31.6	21.5	21.1	21.3	20.2	19.2	19.0
1200	15.6	19.5	32.8	21.4	20.7	20.3	19.7	19.4	19.0
1230	16.3	20.7	34.0	22.4	21.3	21.1	21.1	20.3	20.0
1300	15.6	21.3	34.4	22.6	21.9	21.8	21.2	20.4	19.6
1330	16.2	22.4	35.7	22.4	22.0	21.6	21.6	20.7	20.6
1400	15.6	23.0	37.0	22.8	22.1	21.9	21.4	20.7	20.4
1430	16.3	23.9	37.9	23.2	22.9	22.5	22.1	21.5	21.0
1500	15.7	24.3	38.0	23.0	22.6	22.3	21.8	21.3	21.1
1530	16.3	25.2	37.5	23.7	23.0	22.7	22.0	21.7	21.0
1600	15.7	25.3	36.0	22.1	21.8	21.4	20.9	20.9	20.3
1630	16.3	26.0	35.2	22.3	21.9	21.3	20.5	20.1	20.0
1700	15.7	25.8	33.3	21.4	21.3	20.6	20.1	19.8	19.3
1730	16.2	26.2	31.7	21.4	21.3	20.3	20.0	19.4	19.0
1800	15.7	25.7	29.9	20.3	19.8	19.5	19.1	18.9	18.5
1830	16.3	26.0	28.3	20.5	20.3	20.0	19.5	19.1	18.7
1900	15.5	25.2	26.4	20.0	19.7	19.6	19.3	19.2	18.5
1930	16.1	25.2	25.1	19.6	19.5	19.5	19.4	19.1	18.5
2000	15.5	24.5	23.8	19.0	18.5	18.7	18.9	18.6	18.7
2030	16.0	24.4	22.6	16.8	17.0	17.4	17.6	17.9	19.9
2100	15.4	23.6	21.0	13.9	14.6	15.5	16.7	18.8	19.9
2130	15.9	23.5	20.1	13.6	14.8	15.4	16.8	19.4	20.1
2200	15.4	22.7	19.1	14.2	14.3	15.0	17.0	19.5	20.0
2230	15.7	22.4	18.8	12.3	13.0	15.5	16.6	18.7	20.3
2300	15.3	21.7	17.9	13.0	13.5	14.6	15.4	17.6	19.9
2330	15.7	21.5	17.6	13.4	13.8	14.9	15.6	17.3	18.5
2400	15.3	20.7	17.3	14.2	14.3	14.4	15.2	16.2	17.5

TABLE A3. Air temperature (T) in ^{o}C, wet bulb temperature (T_w) in ^{o}C, relative humidity (RH) in %, and water vapor pressure (e) in mb observed from aircrafts in a cross section along an observation line south of Grand Haven, Michigan, 25 June, 1965. Time is EST. Position coordinates for the aircraft are given in meters. X-direction is perpendicular to the shore and X is positive toward the east and zero at the shore. Z is positive upward.

Time	Aircraft position		Temperature and Moisture			
	X	Z	T	T_w	e	RH
073710	32188.0	152.5	13.4	10.3	8.687	68.0
074000	7242.3	152.5	12.9	10.0	8.303	65.0
074500	8690.7	152.5	13.0	10.2	9.070	71.0
074750	.0	152.5	13.2	10.2	8.814	69.0
074900	-2575.0	152.5	13.7	10.1	8.176	64.0
075000	-5311.0	152.5	13.4	10.2	8.431	66.0
075100	-8047.0	152.5	13.7	10.1	8.176	64.0
075500	-18669.0	152.5	14.6	10.4	7.665	60.0
080000	-32188.0	152.5	14.7	9.8	6.381	52.0
080030	-32188.0	305.0	14.3	9.1	6.011	51.0
080205	-32188.0	457.5	14.2	8.4	5.014	44.0
080335	-32188.0	610.0	13.7	7.0	3.552	35.0
080505	-32188.0	762.5	12.4	6.1	3.531	36.0
080655	-32188.0	915.0	10.9	5.5	3.952	42.0
080840	-32188.0	1067.5	9.6	5.0	4.363	48.0
081025	-32188.0	1220.0	8.4	4.5	4.708	54.0
081225	-32188.0	1372.5	7.3	3.1	4.101	53.0
081425	-32188.0	1525.0	6.7	1.8	2.719	38.0
081625	-32188.0	1677.5	6.2	-.1	1.221	20.0
081855	-32188.0	1830.0	6.2	-.1	1.221	20.0
082115	-32188.0	1982.5	5.6			
082330	-32188.0	2135.0	5.6			
083000	-17703.4	2135.0	6.2			
083500	-6598.5	2135.0	6.2			
083800	.0	2135.0	6.2			
084500	20278.4	2135.0	6.7			
084930	32188.0	2135.0	6.6			
085055	32188.0	1982.5	6.9			
085215	32188.0	1830.0	7.2	-.6	.292	5.0
085345	32188.0	1677.5	7.5	.2	1.020	16.0
085510	32188.0	1525.0	7.9	.1	.701	11.0
085650	32188.0	1372.5	8.6	.6	.727	11.0
085810	32188.0	1220.0	9.0	1.8	1.502	21.0
085940	32188.0	1067.5	9.0	3.1	2.553	33.0
090100	32188.0	915.0	10.0	4.4	3.313	38.0
090220	32188.0	762.5	10.6	6.2	5.002	51.0
090350	32188.0	610.0	11.2	8.5	7.749	68.0
090515	32188.0	457.5	12.9	9.5	7.976	65.0
090635	32188.0	305.0	14.1	10.3	8.048	63.0
090745	32188.0	152.5	15.6	11.1	7.283	53.0

Time	Aircraft position		Temperature and Moisture			
	X	Z	T	T_w	e	RH
095300	32188.0	152.5	16.5	11.2	7.145	52.0
100000	11587.6	152.5	16.5	11.3	7.283	53.0
100405	.0	152.5	17.0	11.2	6.596	48.0
101000	-16737.7	152.5	15.1	11.0	8.056	61.0
101530	-32188.0	152.5	14.6	10.6	8.188	62.0
101630	-32188.0	305.0	14.2	9.3	6.129	52.0
101750	-32188.0	457.5	13.4	7.8	4.924	45.0
101905	-32188.0	610.0	13.5	5.7	2.446	26.0
102025	-32188.0	762.5	12.1	5.3	2.909	32.0
102155	-32188.0	915.0	11.0	3.9	2.257	27.0
102320	-32188.0	1067.5	10.4	4.3	2.842	34.0
102500	-32188.0	1220.0	9.0	4.3	3.846	46.0
102625	-32188.0	1372.5	8.0	2.8	3.017	39.0
102805	-32188.0	1525.0	8.4	.2	.510	8.0
103030	-32188.0	1677.5	8.0	.1	.637	10.0
103220	-32188.0	1830.0	7.6	-.4	.366	6.0
103425	-32188.0	1982.5	6.6			
103640	-32188.0	2135.0	5.9			
104000	-25267.5	2135.0	6.5			
104200	-20600.3	2135.0	6.2			
104500	-13840.8	2135.0	6.3			
105000	- 2253.1	2135.0	6.6			
105100	.0	2135.0	6.5			
105500	10300.1	2135.0	6.5			
110000	23336.3	2135.0	6.5			
110320	32188.0	2135.0	6.7			
110455	32188.0	1982.5	6.9			
110605	32188.0	1830.0	7.6	-.8	.058	1.0
110730	32188.0	1677.5	8.3	.1	.701	11.0
110905	32188.0	1525.0	8.4	- .2	.061	1.0
111040	32188.0	1372.5	9.5	.4	.127	2.0
111210	32188.0	1220.0	9.1	2.0	1.431	20.0
111340	32188.0	1067.5	8.7	5.8	6.023	64.0
111500	32188.0	915.0	10.3	7.0	6.192	61.0
111610	32188.0	762.5	11.6	8.1	6.784	62.0
111720	32188.0	610.0	13.0	8.7	6.382	56.0
111840	32188.0	457.5	14.7	9.6	6.872	56.0
112000	32188.0	305.0	15.9	10.3	6.259	49.0
112105	32188.0	152.5	17.5	10.8	5.546	42.0

Time	Aircraft position		Temperature and Moisture			
	X	Z	T	T_w	e	RH
123145	32188.0	152.5	18.9	12.2	6.352	43.0
123500	21405.0	152.5	19.0	11.7	5.681	40.0
124000	9334.5	152.5	19.1	11.8	5.681	40.0
124330	.0	152.5	17.3	11.0	5.943	45.0
124500	- 3701.6	152.5	17.3	11.2	6.321	46.0
125000	-16094.0	152.5	16.9	10.9	6.075	46.0
125615	-32188.0	152.5	16.4	8.7	3.647	32.0
125650	-32188.0	305.0	15.5	8.1	3.611	33.0
125805	-32188.0	457.5	14.4	7.2	3.384	32.0
125945	-32188.0	610.0	13.4	5.9	2.541	27.0
130100	-32188.0	762.5	12.1	5.1	2.636	29.0
130235	-32188.0	915.0	10.6	3.6	2.098	26.0
130405	-32188.0	1067.5	10.2	2.3	1.344	18.0
130550	-32188.0	1220.0	9.7	1.5	.828	12.0
130735	-32188.0	1372.5	9.3	.3	.191	3.0
130920	-32188.0	1525.0	9.0	-.1		
131100	-32188.0	1677.5	8.0	.2	.574	9.0
131245	-32188.0	1830.0	8.0	-.4	.122	2.0
131435	-32188.0	1982.5	7.1	-1.0	.116	2.0
131645	-32188.0	2135.0	6.5			
132000	-25750.4	2135.0	6.9			
132500	-14967.4	2135.0	6.6			
133200	.0	2135.0	6.5			
133500	7403.2	2135.0	7.0			
134445	32188.0	2135.0	6.5			
134630	32188.0	1982.5	6.5			
134745	32188.0	1830.0	6.5	- .6	.643	11.0
134905	32188.0	1677.5	6.8	1.7	2.647	37.0
135030	32188.0	1525.0	6.7	3.7	4.924	61.0
135145	32188.0	1372.5	7.6	5.9	7.435	79.0
135250	32188.0	1220.0	9.2	6.9	7.207	71.0
135400	32188.0	1067.5	10.7	7.6	6.875	65.0
135545	32188.0	915.0	12.2	8.7	7.180	63.0
135730	32188.0	762.5	13.6	6.7	3.349	33.0
135840	32188.0	610.0	15.1	10.2	6.898	54.0
140030	32188.0	457.5	16.5	10.8	6.603	50.0
140245	32188.0	305.0	18.5	11.9	6.533	46.0
140400	32188.0	152.5	20.1	12.7	6.106	40.0

TABLE A4. Wind direction (WD) in degrees and wind speeds in m sec^{-1} for several stations near an observation line south of Grand Haven, Michigan, 25 June, 1965. VT indicates total horizontal vector wind, U the across shore component - onshore wind is positive and from the west -, and V the along shore component - southerly wind is positive. Winds at three levels at WJBL are given. MYSIS' off shore distance (X) in km is given.

TIME	WJBL 10 M				WJBL 20 M				WJBL 40 M				LAKE SHORE		8 KM				16 KM				LAKE TOWER				MYSIS					GRR				MKG				TIME
	WD	VT	U	V	WD	VT	U	V	WD	VT	U	V	WD	VT	WD	VT	U	V	WD	VT	U	V	WD	VT	U	V	X	WD	VT	U	V	WD	VT	U	V	WD	VT	U	V	
0030													45	1.0	045	1.5	-1.1	-1.1	0	0	0	0	360	2.1	0	-2.1														0030
0100	0	0	0	0	045	1.8	-1.3	-1.3	055	4.0	-3.3	-2.3			045	0.7	-0.5	-0.5	0	0			050	4.1	-3.2	-2.6						010	2.1	-0.4	-2.1	030	2.6	-1.3	-2.3	0100
0130															360	0.5	0	-0.5	270	0.9	0.9	0	040	3.1	-2.0	-2.4														0130
0200	0	0	0	0	050	1.8	-1.4	-1.2	075	4.0	-3.9	-1.0			360	0.6	0	-0.6	270	1.0	1.0	0	060	3.1	-2.7	-1.6						0	0	0	0	040	2.1	-1.4	-1.6	0200
0230															360	0.5	0	-0.5	270	0.9	0.9	0	060	1.5	-1.3	-0.8														0230
0300	0	0	0	0	055	1.8	-1.5	-1.0	075	3.6	-3.5	-0.9			0	0	0	0	0	0	0	0	060	2.1	-1.8	-1.1						340	1.5	0.5	-1.4	030	2.6	-1.3	-2.3	0300
0330															360	0.5	0	-0.5	315	0.5	0.4	-0.4	050	3.6	-2.8	-2.3														0330
0400	0	0	0	0	085	1.8	-1.8	-0.2	095	2.2	-2.2	0.2	45	4.0	0	0	0	0	0	0	0	0	050	3.6	-2.8	-2.3						060	2.6	-2.3	-1.3	040	2.1	-1.4	-1.6	0400
0430															0	0	0	0	0	0	0	0	060	3.6	-3.1	-1.8														0430
0500	0	0	0	0	075	1.8	-1.7	-0.5	085	3.6	-3.6	-0.3			0	0	0	0	0	0	0	0	060	3.6	-3.1	-1.8						030	2.6	-1.3	-2.3	050	2.1	-1.6	-1.4	0500
0530															360	0.9	0	-0.9	0	0	0	0	060	4.6	-4.0	-2.3														0520
0600	085	1.3	-1.3	-0.1	095	1.8	-1.8	0.2	095	3.6	-3.6	0.3			0	0	0	0	0	0	0	0	070	4.1	-3.9	-1.4	-1.6	110	4.6	-4.3	1.6	060	2.6	-2.3	-1.3	060	2.1	-1.8	-1.1	0600
0630															0	0	0	0	0	0	0	0	070	4.6	-4.3	-1.6	-1.6	125	5.1	-4.2	2.9									0630
0700	115	1.3	-1.2	0.6	120	2.2	-1.9	1.1	115	3.1	-2.8	1.3			045	1.5	-1.1	-1.1	360	0.3	0	-0.3	080	4.6	-4.4	-0.8	-6.4	105	2.6	-2.5	0.7	060	2.6	-2.3	-1.3	110	3.1	-2.9	1.1	0700
0730															045	2.7	-1.9	-1.9	015	1.8	-0.4	-1.7	080	4.6	-4.4	-0.8														0730
0800	110	2.2	-2.1	0.8	130	2.7	-2.0	1.7	125	2.7	-1.9	1.9	90	2.5	090	3.3	-3.3	0	045	2.4	-1.7	-1.7	070	4.1	-4.0	-2.3						050	4.1	-3.1	-2.6	110	3.6	-3.4	1.2	0800
0830															135	3.6	-2.6	2.6	045	2.4	-1.7	-1.7	080	4.6	-4.4	-0.8	-4.8	110	3.1	-2.9	1.1									0830
0900	110	3.1	-2.9	1.1	120	3.6	-3.1	1.8	115	3.1	-2.8	1.3			090	3.3	-3.3	0	080	1.9	-1.9	-0.3	090	4.6	-4.6	0	-1.6	085	2.6	-2.6	-0.2	080	5.2	-5.1	-0.9	100	3.6	-3.5	0.6	0900
0930															110	3.3	-3.1	1.1	060	2.2	-1.9	-1.1	100	2.6	-2.6	0.5	-1.6	085	2.6	-2.6	-0.2									0930
1000	095	2.7	-2.7	0.2	105	2.7	-2.6	0.7	110	2.7	-2.5	0.9			090	3.0	-3.0	0	045	1.8	-1.3	-1.3	110	2.1	-2.0	0.7						070	4.1	-3.1	-1.4	090	3.1	-3.1	0	1000
1030															080	2.5	-2.5	-0.4	045	1.6	-1.1	-1.1	240	2.1	1.8	1.1	-6.4	000	0	0	0									1030
1100	085	2.2	-2.2	-0.2	090	2.7	-2.7	0	090	2.7	-2.7	0			090	2.2	-2.2	0	360	1.6	0	-1.6	250	2.1	2.0	0.7	-6.4	290	2.1	2.0	-0.7	060	2.6	-2.6	-1.3	050	2.6	-2.0	-1.7	1100
1130															090	2.4	-2.4	0	010	1.8	-0.3	-1.8	290	2.6	2.4	-0.9	-1.6	270	4.1	4.1	0									1130
1200	055	1.8	-1.5	-1.0	080	2.2	-2.2	-0.4	080	1.8	-1.8	-0.3	360	2.5	110	1.9	-1.8	0.7	360	1.9	0	-1.9	280	2.6	2.6	-0.5	-1.3	275	4.6	4.6	-0.4	030	4.6	-2.3	-4.0	090	2.6	-2.6	0	1200
1230															090	2.1	-2.1	0	360	1.9	0	-1.9	320	2.1	1.4	-1.6														1230
1300	M	2.2	-	-	060	2.7	-2.3	-1.3	075	2.2	-2.2	-0.6			090	2.5	-2.5	0	045	1.8	-1.3	-1.3	310	3.1	2.4	-2.0	-1.6	305	4.6	3.8	-2.6	300	2.6	2.3	-1.3	170	2.1	0	2.1	1300
1330															090	2.8	-2.8	0	045	2.1	-1.5	-1.5	310	3.6	2.8	-2.3														1330
1400	060	1.8	-1.6	-0.9	080	2.7	-2.6	-0.5	075	2.2	-2.2	-0.6			110	2.5	-2.4	0.9	020	2.2	-0.8	-2.1	320	3.6	2.3	-2.8	-6.4	350	3.6	0.6	-3.6	080	4.1	-4.0	-0.7	300	4.1	3.6	-2.1	1400
1430															110	2.1	-2.0	0.7	045	1.9	-1.3	-1.3	330	4.6	2.3	-4.0														1430
1500	080	2.7	-2.6	-0.5	095	2.2	-2.2	0.2	090	2.2	-2.2	0			105	2.4	-2.3	0.6	025	1.8	-0.8	-1.6	330	4.1	2.1	-3.6						090	2.6	-2.6	0	310	3.1	2.4	-2.0	1500
1530															110	2.5	-2.4	0.9	065	1.8	-1.6	-0.8	330	4.6	2.3	-4.0														1530
1600	M	2.7	-	-	110	2.7	-2.5	0.9	105	2.7	-2.6	0.7	315	2.5	290	2.5	2.4	-0.9	055	2.2	-1.8	-1.3	330	5.2	2.6	-4.5						120	4.6	-4.0	2.3	330	3.1	1.6	-2.7	1600
1630															290	4.8	4.5	-1.6	090	1.6	-1.6	0	330	4.6	2.3	-4.0														1630
1700	300	4.0	3.5	-2.0	320	4.0	2.6	-3.1	325	3.6	2.0	-2.9			290	4.0	3.8	-1.4	100	1.5	-1.5	0.3	330	5.7	2.9	-4.9						110	3.6	-3.4	1.2	310	3.1	2.4	-2.0	1700
1730															305	4.6	3.8	-2.6	090	1.9	-1.9	0	330	5.7	2.9	-4.9														1730
1800	315	4.0	2.8	-2.8	330	3.6	1.8	-3.1	325	3.1	1.8	-2.6			290	4.2	4.0	-1.4	090	1.8	-1.8	0	330	5.2	2.6	-4.5						120	2.1	-1.8	1.1	300	2.6	2.3	-1.3	1800
1830															285	3.0	2.8	-0.8	250	2.1	2.0	0.7	340	5.2	1.8	-4.9														1830
1900	330	2.7	1.3	-2.3	360	2.7	0	-2.7	335	2.7	1.1	-2.4			280	2.4	2.4	-0.4	250	1.6	1.5	0.5	340	4.1	1.4	-3.9						090	3.1	-3.1	0	300	2.6	2.3	-1.3	1900
1930															270	1.2	1.2	0	260	1.0	1.0	0.2	350	3.6	0.6	-3.6	-1.8	040	4.4	-2.8	-3.4									1930
2000	360	2.2	0	-2.2	360	2.7	0	-2.7	010	3.1	-0.5	-3.1	90	1.0	0	0	0	0	270	0.6	0.6	0	010	2.6	-0.5	-2.6	-1.8	025	2.3	-1.0	-2.1	070	2.1	-2.0	-0.7	020	3.1	-1.1	-2.9	2000
2030															0	0	0	0	0	0	0	0	030	1.5	-0.8	-1.3	-1.8	064	1.4	-1.3	-0.6									2030
2100	030	1.8	-0.8	-1.6	040	3.1	-2.0	-2.4	055	3.6	-2.9	-2.0			0	0	0	0	0	0	0	0	040	2.1	-1.4	-1.6						060	2.1	-1.8	-1.1	030	2.6	-1.3	-2.3	2100
2130															0	0	0	0	0	0	0	0	060	2.6	-2.3	-1.3														2130
2200	055	1.3	-1.1	-0.8	075	3.1	-3.0	-0.8	090	2.7	-2.7	0			360	0.7	0	-0.7	0	0	0	0	070	3.6	-3.4	-1.2						090	2.6	-2.6	0	100	2.6	-2.6	0.5	2200
2230															045	1.5	-1.1	-1.1	0	0	0	0	080	3.6	-3.5	-0.6														2230
2300	090	1.8	-1.8	0	110	3.6	-3.4	1.2	120	4.9	-4.3	2.5			045	2.1	-1.5	-1.5	045	0.9	-0.6	-0.6	090	4.1	-4.1	0														2300
2330															045	3.3	-2.3	-2.3	065	1.3	-1.2	-0.6	090	5.2	-5.2	0														2330
2400	110	2.7	-2.5	0.9	120	3.6	-3.1	1.8	125	6.3	-5.1	3.6	90	4.0	045	2.5	-1.8	-1.8	090	2.1	-2.1	0	100	5.7	-5.6	1.0														2400

TABLE A5. Analyses of pibal observations made at stations along an observation line south of Grand Haven, Michigan, 25 June, 1965. Time is EST. Position coordinates for the balloon are given in meters. X-direction is perpendicular to the shore and x is positive inland toward the east and zero at the shore. Y-direction is parallel to the shore and V is positive toward north. Z is positive upward. Wind speeds are given in m sec^{-1}. VT is horizontal vector wind, and U, V, and W components are positive along positive X, Y, and Z axes respectively.

The data presented in this tabulation are summarized in Table 1 on page 19. Analyses of tracks made on balloons released from the MYSIS are presented first, followed by the double theodolite analyses made on balloons released from the Lake shore station, and the single theodolite analyses made on balloons released from that station. Double theodolite analyses preceed single theodolite analyses also for the releases from the 8 km station.

Single Theodolite Data - Shoreline Station - MYSIS

Time	Balloon Position			Wind Velocity		
	X	Y	Z	U	V	VT
0630.00	.0	.0	.0			
0630.50	-1866.7	-104.3	91.4	-62.22	-3.47	62.32
0631.00	-2086.1	-131.2	182.8	- 7.31	- .89	7.37
0631.50	-2257.1	-209.3	274.3	- 5.69	-2.60	6.26
0632.00	-2368.6	-320.2	365.7	- 3.71	-3.69	5.24
0632.50	-2453.4	-436.8	457.2	- 2.79	-3.88	4.78
0633.00	-2477.4	-549.2	548.6	- .83	-3.74	3.83
0633.50	-2500.6	-660.6	640.0	- .77	-3.71	3.79
0634.00	-2541.0	-772.0	731.5	- 1.34	-3.71	3.94
0634.50	-2578.8	-882.8	822.9	- 1.25	-3.69	3.90
0635.00	-2592.9	-1005.7	914.4	- .47	-4.09	4.12
0635.50	-2608.7	-1123.4	1005.8	- .52	-3.92	3.96
0636.00	-2643.6	-1238.3	1097.2	- 1.16	-3.82	4.00
0636.50	-2693.6	-1360.6	1188.7	- 1.66	-4.07	4.40
0637.00	-2740.9	-1525.5	1280.1	- 1.57	-5.49	5.72
0637.50	-2767.1	-1729.0	1371.6	- .87	-6.78	6.83
0638.00	-2759.2	-1953.6	1463.0	.26	-7.48	7.49
0638.50	-2756.7	-2169.2	1554.4	.08	-7.18	7.18
0639.00	-2767.7	-2372.2	1645.9	- .36	-6.76	6.77
0639.50	-2806.7	-2553.8	1737.3	- 1.29	-6.05	6.19
0640.00	-2785.8	-2785.8	1828.8	.69	-7.73	7.76
0640.50	-2688.7	-2923.8	1920.2	3.23	-4.60	5.62
0641.00	-2681.1	-3062.5	2011.6	.25	-4.62	4.62
0641.50	-2676.2	-3189.3	2103.1	.16	-4.22	4.23
0642.00	-2635.5	-3313.3	2194.5	1.35	-4.13	4.34
0642.50	-2539.4	-3491.7	2286.0	3.20	-5.94	6.75
0643.00	-2339.7	-3701.1	2377.4	6.65	-6.97	9.64

Single Theodolite Data - Shoreline Station - MYSIS

Time	Balloon Position			Wind Velocity		
	X	Y	Z	U	V	VT
0900.00	.0	.0	.0			
0900.50	-1652.6	80.6	91.4	-55.08	2.68	55.15
0901.00	-1438.6	161.3	182.8	7.13	2.68	7.62
0901.50	-1682.4	194.6	274.3	8.12	1.11	8.20
0902.00	-1800.4	221.0	365.7	-3.93	.87	4.02
0902.50	-1935.9	227.4	457.2	-4.51	.21	4.52
0903.00	-2080.5	211.3	548.6	-4.82	-.53	4.85
0903.50	-2227.0	151.8	640.0	-4.88	-1.98	5.26
0904.00	-2291.4	56.0	731.5	-2.14	-3.19	3.84
0904.50	-2363.1	-16.4	822.9	-2.38	-2.41	3.39
0905.00	-2418.2	-88.6	914.4	-1.83	-2.40	3.02
0905.50	-2470.7	-177.0	1005.8	-1.74	-2.94	3.42
0906.00	-2490.0	-327.7	1097.2	- .64	-5.02	5.06
0906.50	-2485.8	-510.2	1188.7	.14	-6.08	6.08
0907.00	-2443.0	-714.3	1280.1	1.42	-6.80	6.95
0907.50	-2412.7	-849.6	1371.6	1.00	-4.50	4.62
0908.00	-2364.1	-1047.6	1463.0	1.62	-6.59	6.79
0908.50	-2357.5	-1185.7	1554.4	.21	-4.60	4.60
0909.00	-2388.6	-1318.5	1645.9	-1.03	-4.42	4.54
0909.50	-2460.2	-1408.9	1737.3	-2.38	-3.01	3.84
0910.00	-2519.1	-1489.7	1828.8	-1.96	-2.69	3.33
0910.50	-2584.3	-1596.1	1920.2	-2.17	-3.54	4.15
0911.00	-2616.9	-1745.2	2011.6	-1.08	-4.97	5.08
0911.50	-2626.6	-1894.3	2103.1	- .32	-4.96	4.98
0912.00	-2638.2	-2091.0	2194.5	- .38	-6.55	6.56
0912.50	-2705.8	-2230.5	2286.0	-2.25	-4.64	5.16
0913.00	-2674.3	-2459.1	2377.4	1.05	-7.62	7.69
0913.50	-2692.9	-2683.5	2468.8	- .62	-7.47	7.50
0914.00	-2684.0	-2929.0	2560.3	.29	-8.18	8.19
0914.50	-2674.7	-3210.2	2651.7	.31	-9.37	9.37
0915.00	-2609.4	-3488.0	2743.2	2.17	-9.26	9.51
0915.50	-2559.7	-3766.5	2834.6	1.65	-9.28	9.42
0916.00	-2482.5	-4035.2	2926.0	2.57	-8.95	9.31
0916.50	-2426.8	-4306.8	3017.5	1.85	-9.05	9.24
0917.00	-2381.1	-4593.6	3108.9	1.52	-9.56	9.68
0917.50	-2373.2	-4887.4	3200.4	.26	-9.79	9.79
0918.00	-2355.4	-5192.3	3291.8	.59	-10.16	10.18
0918.50	-2279.4	-5476.0	3383.2	2.53	-9.45	9.78
0919.00	-2209.9	-5757.0	3474.7	2.31	-9.36	9.64
0919.50	-2121.4	-6059.7	3566.1	2.95	-10.09	10.51
0920.00	-2022.8	-6338.1	3657.6	3.28	-9.28	9.84

Single Theodolite Data - MYSIS

	Balloon Position			Wind Velocity		
Time	X	Y	Z	U	V	VT
0902.00	.0	.0	.0			
0902.50	-1706.0	- 25.8	90.0	-3.70	-0.65	3.71
0903.00	-1808.0	- 51.2	180.0	-2.60	-0.45	3.80
0903.50	-1928.2	- 69.4	270.0	-3.95	0.20	3.95
0904.00	-2044.2	- 46.5	360.0	-3.83	0.99	3.95
0904.50	-2157.7	- 9.8	450.0	-4.31	-1.71	4.64
0905.00	-2303.0	- 149.1	540.0	-3.72	-3.32	4.99
0905.50	-2380.9	- 208.8	630.0	-1.67	-2.64	3.13
0906.00	-2403.1	- 307.6	720.0	-1.09	-3.09	3.27
0906.50	-2446.6	- 393.9	810.0	-2.02	-2.71	3.38
0907.00	-2524.5	- 470.2	900.0	- .25	-2.74	2.75
0907.50	-2461.8	- 558.5	990.0	.89	-3.90	4.00
0908.00	-2471.2	- 704.0	1080.0	.30	-5.22	5.23
0908.50	-2443.7	- 871.7	1170.0	3.61	-7.10	7.97
0909.00	-2254.4	-1130.1	1260.0	4.55	-6.76	8.15
0909.50	-2170.6	-1277.3	1350.0	3.35	-5.78	6.68
0910.00	-2053.5	-1476.9	1440.0	2.40	-5.13	5.66
0910.50	-2026.7	-1585.0	1530.0	.46	-3.22	3.25
0911.00	-2080.9	-1670.1	1620.0	-1.35	-2.97	3.26
0911.50	-2107.5	-1762.9	1710.0	- .08	-4.50	4.50
0912.00	-2085.6	-1939.9	1800.0	.89	-6.07	6.13
0912.50	-2054.1	-2126.9	1890.0	- .12	- 6.14	6.14
0913.00	-2092.6	-2308.4	1980.0	.39	-5.05	5.06
0913.50	-2030.4	-2429.7	2070.0	.73	-3.78	3.85
0914.00	-2049.0	-2535.4	2160.0	-1.70	-4.97	5.25
0914.50	-2132.2	-2727.8	2250.0	-1.22	-6.91	7.02

Single Theodolite Data - MYSIS

	Balloon Position			Wind Velocity		
Time	X	Y	Z	U	V	VT
1101.00	.0	.0	.0			
1101.50	-6396.8	- 11.2	90.0	.04	-1.09	1.09
1102.00	-6405.7	- 65.5	180.0	- .11	-1.91	1.91
1102.50	-6403.6	- 125.9	270.0	- .48	-1.67	1.74
1103.00	-6434.3	- 165.8	360.0	-1.65	-1.29	2.10
1103.50	-6502.8	- 203.4	450.0	-2.54	-1.49	2.95
1104.00	-6586.8	- 255.4	540.0	-3.43	-1.62	3.79
1104.50	-6708.6	- 300.6	630.0	-3.82	-1.45	4.09
1105.00	-6816.2	- 342.6	720.0	-4.05	-1.45	4.31
1105.50	-6951.6	- 387.8	810.0	-4.33	-1.52	4.59
1106.00	-7075.8	- 433.8	900.0	-3.76	-1.55	4.07
1106.50	-7177.4	- 480.8	990.0	-3.18	-1.54	3.54
1107.00	-7266.8	- 526.3	1080.0	-2.79	-2.51	3.76
1107.50	-7344.8	- 631.9	1170.0	-1.88	-3.43	3.92
1108.00	-7379.8	- 732.4	1260.0	- .74	-3.19	3.28
1108.50	-7389.4	- 823.6	1350.0	- .44	-2.77	2.81
1109.00	-7406.0	- 898.7	1440.0	- .46	-3.09	3.12
1109.50	-7416.9	-1009.0	1530.0	-1.17	-3.46	3.65
1110.00	-7476.0	-1106.1	1620.0	-1.11	-3.44	3.62
1110.50	-7483.3	-1215.6	1710.0	-1.25	-2.73	3.00
1111.00	-7551.0	-1269.6	1800.0	-1.58	-1.03	1.88
1111.50	-7578.1	-1277.1	1890.0	-1.23	- .15	1.24
1112.00	-7624.0	-1260.3	1980.0	- .97	- .08	.97
1112.50	-7636.2	-1272.1	2070.0	-1.45	- .02	1.45
1113.00	-7711.9	-1259.3	2160.0	-2.37	-2.87	3.72
1113.50	-7778.4	-1444.2	2250.0	-1.77	-5.11	5.41

Double Theodolite Data - Shoreline Station - MYSIS

Time	Balloon Position			Wind Velocity		
	X	Y	Z	U	V	W
1200.00	-1336.2	79.3	.2			
1200.50	-1205.1	34.2	77.6	4.37	-1.50	-.46
1201.00	-1122.7	-26.9	161.5	2.74	-2.03	-.25
1201.50	-1087.5	-94.2	253.5	1.17	-2.24	.01
1202.00	-1081.2	-150.2	351.9	.20	-1.86	.23
1202.50	-1098.9	-190.7	452.3	-.59	-1.34	.29
1203.00	-1133.8	-227.2	551.0	-1.16	-1.21	.24
1203.50	-1181.4	-277.4	648.7	-1.58	-1.67	.20
1204.00	-1243.4	-342.5	753.7	-2.06	-2.16	.45
1204.50	-1330.0	-405.2	865.3	-2.88	-2.09	.67
1205.00	-1442.0	-447.7	966.1	-3.73	-1.41	.30
1205.50	-1569.2	-466.8	1055.8	-4.24	-.63	-.05
1206.00	-1713.9	-475.5	1149.3	-4.82	-.29	.07
1206.50	-1873.0	-486.8	1249.5	-5.30	-.37	.28
1207.00	-2025.0	-506.6	1353.0	-5.06	-.65	.40
1207.50	-2126.7	-526.6	1449.4	-3.39	-.66	.16
1208.00	-2163.4	-535.4	1533.4	-1.22	-.29	-.24
1208.50	-2189.6	-538.7	1626.2	-.87	-.10	.04
1209.00	-2230.1	-529.2	1729.8	-1.34	.31	.40
1209.50	-2262.9	-494.4	1817.2	-1.09	1.15	-.13
1210.00	-2322.9	-460.4	1902.3	-2.00	1.13	-.21
1210.50	-2426.5	-443.5	1995.8	-3.45	.56	.06
1211.00	-2545.5	-430.7	2085.5	-3.96	.42	-.05
1211.50	-2672.2	-422.4	2170.8	-4.22	.27	-.20
1212.00	-2791.6	-425.5	2239.6	-3.98	-.10	-.75
1212.50	-2917.6	-449.3	2308.5	-4.19	-.79	-.74
1213.00	-3057.9	-501.7	2398.3	-4.67	-1.74	-.05
1213.50	-3179.5	-567.3	2488.8	-4.05	-2.18	-.02
1214.00	-3316.0	-640.2	2580.5	-4.55	-2.43	.00
1214.50	-3494.8	-737.1	2687.2	-5.96	-3.22	.50
1215.00	-3656.9	-863.4	2798.1	-5.40	-4.21	.64
1215.50	-3766.7	-1009.7	2895.5	-3.66	-4.87	.19
1216.00	-3819.7	-1156.4	2969.7	-1.76	-4.88	-.57
1216.50	-3869.6	-1304.4	3063.2	-1.66	-4.93	.06
1217.00	-3948.6	-1454.5	3189.4	-2.63	-5.00	1.15
1217.50	-4021.3	-1616.5	3310.2	-2.42	-5.39	.97
1218.00	-4019.5	-1774.3	3367.4	.06	-5.26	-1.14
1218.50	-3961.5	-1914.2	3367.0	1.93	-4.66	-3.06
1219.00	-4003.7	-2099.4	3435.3	-1.40	-6.17	-.76
1219.50	-4091.2	-2311.0	3540.8	-2.91	-7.05	.46
1220.00	-4114.3	-2501.2	3601.1	-.76	-6.33	-1.03

Single Theodolite Data - MYSIS

	Balloon Position			Wind Velocity		
Time	X	Y	Z	U	V	VT
1203.00	.0	.0	.0			
1203.50	-1494.7	.01	90.0	3.65	-1.19	3.84
1204.00	-1382.9	- 71.2	108.0	2.58	-2.42	3.54
1204.50	-1339.7	-145.4	270.0	.87	-2.10	2.28
1205.00	-1330.4	-197.4	360,0	- .81	- .90	1.21
1205.50	-1388.3	-199.3	450.0	-1.12	- .91	1.45
1206.00	-1397.8	-252.2	540.0	- .35	-1.53	1.57
1206.50	- 1409.2	-291.3	630.0	-1.48	-2.31	2.74
1207.00	-1486.3	-390.7	720.0	-2.17	-2.56	3.35
1207.50	-1539.5	-444.7	810.0	-2.52	-1.96	3.19
1208.00	-1637.5	-508.0	900.0	-2.86	-1.94	3.46
1208.50	-1711.1	-561.2	990.0	-3.54	-1.76	3.95
1209.00	-1849.9	-613.7	1080.0	-4.32	-1.72	4.65
1209.50	- 1970.4	-664.7	1170.0	-4.92	- 1.36	5.11
1210.00	-2145.2	-695.4	1260.0	-4.39	-1.04	4.51
1210.50	-2233.8	-726.9	1350.0	-3.05	- .52	3.10
1211.00	-2328.4	-726.4	1440.0	-2.18	.05	2.18
1211.50	-2364.8	-724.0	1530.0	- .33	.71	.78
1212.00	-2348.4	-684.1	1620.0	-1.33	1.68	2.14
1212.50	- 2444.5	-623.5	1710.0	-2.92	.65	2.99
1213.00	-2523.5	-645.3	1800.0	-2.74	.10	2.75
1213.50	- 2609.1	-617.3	1890.0	-3.27	- .66	3.33
1214.00	-2719.5	-684.9	1980.0	-3.43	-2.10	4.03
1214.50	- 2815.2	-743.5	2070.0	-3.80	-2.06	4.32
1215.00	-2947.3	-808.5	2160.0	-3.21	-3.41	4.69
1215.50	-3007.8	-948.3	2250.0	-1.26	-5.70	5.84

Single Theodolite Data - MYSIS

	Balloon Position			Wind Velocity		
Time	X	Y	Z	U	V	VT
1347.00	.0	.0	.0			
1347.50	-6291.5	-54.3	90.0	3.36	-1.57	3.71
1348.00	-6206.5	-94.0	180.0	1.78	-1.90	2.60
1348.50	-6184.7	-168.3	270.0	-1.15	-2.96	3.18
1349.00	-6275.6	-271.5	360.0	-2.45	-2.70	3.65
1349.50	-6331.7	-330.6	450.0	-2.95	-1.50	3.31
1350.00	-6452.4	-361.6	540.0	-3.64	- .07	3.64
1350.50	-6550.1	-334.9	630.0	-2.64	.61	2.71
1351.00	-6610.9	-324.7	720.0	-2.32	- .64	2.41
1351.50	-6689.5	-373.6	810.0	- .73	-3.01	3.10
1352.00	-6654.6	-505.6	900.0	-1.09	-3.78	3.93
1352.50	-6754.6	-600.4	990.0	-3.67	-2.69	4.55
1353.00	-6874.8	-666.8	1080.0	-8.28	.53	8.29
1353.50	-7251.3	-568.9	1170.0	-10.30	5.58	11.72
1354.00	-7493.0	-331.8	1260.0	-7.67	9.10	11.90
1354.50	-7711.6	- 22.9	1350.0	-4.92	8.36	9.70
1355.00	-7788.4	169.6	1440.0	-1.01	3.58	3.72
1355.50	-7772.4	191.9	1530.0	.47	- .46	.66
1356.00	-7760.1	142.3	1620.0	- .29	-1.59	1.61
1356.50	-7789.5	96.8	1710.0	- .89	-1.55	1.79
1357.00	-7813.6	49.2	1800.0	-1.53	-3.33	3.67
1357.50	-7881.2	-103.2	1890.0	-3.15	-3.62	4.80
1358.00	-8002.8	-167.8	1980.0	-3.18	-1.69	3.60
1358.50	-8072.0	-204.5	2070.0	-3.17	-2.45	4.01
1359.00	-8193.1	315.0	2160.0	-4.85	-4.55	6.65
1359.50	-8362.9	68.5	2250.0	-3.41	-12.30	12.77

Double Theodolite Data - Shoreline Station

Time	Balloon Position			Wind Velocity		
	X	Y	Z	U	V	W
0600.00	.0	274.3	7.6			
0600.50	- 210.6	246.1	93.8	-7.02	- .93	- .17
0601.00	- 446.5	191.6	179.8	-7.86	- 1.81	- .17
0601.50	- 643.6	105.4	264.9	-6.56	- 2.87	- .21
0602.00	- 767.2	2.2	354.0	-4.12	- 3.44	- .08
0602.50	- 837.1	- 97.4	456.0	-2.32	- 3.32	.38
0603.00	- 856.0	- 189.5	563.0	- .63	- 3.07	.49
0603.50	- 851.4	- 281.4	665.0	.15	- 3.06	.35
0604.00	- 853.0	- 377.8	768.8	- .05	- 3.21	.41
0604.50	- 858.6	- 482.2	870.5	- .18	- 3.48	.34
0605.00	- 870.3	- 600.1	970.9	- .38	- 3.92	.29
0605.50	- 896.5	- 735.5	1078.2	- .87	- 4.51	.52
0606.00	- 932.2	- 880.3	1186.1	-1.19	- 4.82	.54
0606.50	- 971.5	-1035.4	1291.7	-1.30	- 5.17	.47
0607.00	-1011.4	-1218.5	1397.5	-1.32	- 6.10	.47
0607.50	-1035.3	-1429.6	1490.6	- .79	- 7.03	.05
0608.00	-1051.7	-1682.6	1596.1	- .54	- 8.43	.46
0608.50	-1063.0	-1948.4	1712.3	- .37	- 8.85	.82
0609.00	-1068.6	-2187.8	1816.0	- .18	- 7.98	.40
0609.50	-1093.8	-2426.3	1931.7	- .83	- 7.95	.80
0610.00	-1120.6	-2643.5	2036.1	- .89	- 7.23	.43
0610.50	-1131.1	-2798.2	2097.0	- .34	- 5.15	-1.01
0611.00	-1146.2	-2963.7	2181.6	- .50	- 5.51	- .22
0611.50	-1167.8	-3211.7	2339.8	- .72	- 8.26	2.22
0612.00	-1152.7	-3413.7	2467.3	.50	- 6.73	1.20
0612.50	-1098.4	-3556.1	2549.1	1.81	- 4.74	- .32
0613.00	-1040.0	-3786.1	2686.4	1.94	- 7.66	1.53
0613.50	- 950.4	-4030.4	2819.9	2.98	- 8.14	1.40
0614.00	- 826.1	-4216.3	2897.9	4.14	- 6.19	- .44
0614.50	- 704.3	-4384.2	2958.3	4.06	- 5.59	-1.03
0615.00	- 570.7	-4544.2	3002.3	4.45	- 5.33	-1.58
0615.50	- 407.4	-4774.5	3078.5	5.44	- 7.67	- .50
0616.00	- 204.7	-5078.8	3207.7	6.75	-10.14	1.26
0616.50	32.5	-5398.2	3362.0	7.90	-10.64	2.09
0617.00	268.3	-5661.5	3492.6	7.86	- 8.77	1.30
0617.50	509.2	-5861.5	3582.7	8.02	- 6.66	- .04
0618.00	766.2	-6016.7	3632.6	8.56	- 5.17	-1.38
0618.50	1009.6	-6092.9	3619.6	8.11	- 2.54	-3.48
0619.00	1215.7	-6175.9	3597.2	6.86	- 2.76	-3.79
0619.50	1404.0	-6360.1	3623.6	6.27	- 6.13	-2.17
0620.00	1623.0	-6731.4	3747.5	7.30	-12.37	1.08

Double Theodolite Data - Shoreline Station

Time	Balloon Position			Wind Velocity		
	X	Y	Z	U	V	W
0800.00	.0	274.3	7.6			
0800.50	-177.4	285.1	110.6	-5.91	.35	.38
0801.00	-397.9	310.0	219.5	-7.35	.82	.58
0801.50	-629.8	311.6	331.9	-7.72	.05	.69
0802.00	-799.6	248.3	436.1	-5.66	-2.10	.42
0802.50	-885.8	138.0	529.6	-2.87	-3.67	.06
0803.00	-932.6	19.1	623.5	-1.56	-3.96	.08
0803.50	-963.7	-94.6	724.4	-1.03	-3.79	.31
0804.00	-981.7	-204.1	830.9	-.60	-3.64	.50
0804.50	-1000.5	-322.1	938.2	-.62	-3.93	.52
0805.00	-1026.6	-464.9	1042.0	-.87	-4.75	.41
0805.50	-1057.6	-646.4	1144.3	-1.03	-6.05	.36
0806.00	-1075.7	-867.6	1241.0	-.60	-7.37	.17
0806.50	-1065.8	-1109.0	1329.1	.33	-8.04	-.11
0807.00	-1044.3	-1357.7	1427.3	.71	-8.29	.22
0807.50	-1020.4	-1586.5	1535.7	.79	-7.62	.56
0808.00	-1000.5	-1774.6	1643.4	.66	-6.27	.54
0808.50	-1020.3	-1939.1	1752.0	-.66	-5.48	.57
0809.00	-1084.5	-2086.5	1851.3	-2.13	-4.91	.26
0809.50	-1161.7	-2234.2	1949.3	-2.57	-4.92	.21
0810.00	-1223.2	-2395.5	2047.1	-2.04	-5.37	.21
0810.50	-1253.0	-2552.5	2127.4	-.99	-5.23	-.36
0811.00	-1265.4	-2723.6	2214.1	-.41	-5.70	-.15
0811.50	-1263.6	-2923.7	2313.6	.05	-6.67	.26
0812.00	-1306.8	-3322.1	2528.1	-1.43	-13.28	4.10
0812.50	-1348.6	-3726.8	2734.6	-1.39	-13.48	3.83
0813.00	-1253.7	-3749.4	2677.3	3.16	-.75	-4.95
0813.50	-1149.8	-3833.3	2647.4	3.46	-2.79	-4.04
0814.00	-1107.1	-4213.5	2798.1	1.42	-12.67	1.97
0814.50	-1013.8	-4503.0	2880.2	3.10	-9.64	-.31
0815.00	-859.9	-4667.2	2879.0	5.13	-5.47	-3.08
0815.50	-701.6	-4928.0	2944.9	5.27	-8.69	-.85
0816.00	-558.2	-5289.6	3081.6	4.77	-12.05	1.51
0816.50	-411.9	-5560.2	3167.1	4.87	-9.02	-.20
0817.00	-257.7	-5735.7	3188.8	5.13	-5.84	-2.32
0817.50	-99.1	-6059.5	3278.1	5.28	-10.79	-.07
0818.00	54.6	-6422.6	3393.0	5.12	-12.10	.78
0818.50	190.5	-6671.2	3455.4	4.52	-8.28	-.96
0819.00	311.1	-6914.2	3515.1	4.02	-8.10	-1.05
0819.50	421.5	-7018.2	3506.9	3.68	-3.46	-3.32
0820.00	522.3	-6979.1	3429.1	3.36	1.30	-5.64

Double Theodolite Data - Shoreline Station

Time	Balloon Position			Wind Velocity		
	X	Y	Z	U	V	W
0830.00	.0	274.3	776			
0830.50	-167.1	286.8	113.1	-5.57	.41	.46
0831.00	-357.7	302.2	209.2	-6.35	.51	.15
0831.50	-565.3	306.1	299.4	-6.91	.12	-.04
0832.00	-744.5	275.2	394.7	-5.97	-1.02	.12
0832.50	-855.3	205.9	497.3	-3.69	-2.30	.37
0833.00	-902.2	122.7	599.7	-1.56	-2.77	.36
0833.50	-909.6	35.8	698.8	-.24	-2.89	.25
0834.00	-901.3	-57.3	797.5	.27	-3.10	.24
0834.50	-899.4	-147.4	895.7	.06	-3.00	.22
0835.00	-910.0	-237.7	992.2	-.35	-3.00	.16
0835.50	-930.0	-359.1	1088.1	-.66	-4.04	.15
0836.00	-948.8	-536.1	1186.1	-.62	-5.90	.21
0836.50	-944.7	-757.8	1279.5	.13	-7.39	.06
0837.00	-918.7	-999.3	1369.1	.86	-8.04	-.06
0837.50	-890.3	-1239.3	1473.8	.94	-8.00	.44
0838.00	-860.8	-1457.1	1594.5	.98	-7.25	.97
0838.50	-835.2	-1629.7	1703.7	.85	-5.75	.59
0839.00	-840.1	-1757.0	1791.3	-.16	-4.24	-.13
0839.50	-884.6	-1873.6	1874.5	-1.48	-3.88	-.27
0840.00	-944.6	-2011.3	1966.4	-1.99	-4.58	.01
0840.50	-968.8	-2094.2	1997.6	-.80	-2.76	-2.00
0841.00	-975.3	-2194.0	2032.9	-.21	-3.32	-1.86
0841.50	-1014.3	-2463.1	2200.5	-1.30	-8.96	2.53
0842.00	-1037.8	-2738.2	2355.3	-.78	-9.16	2.11
0842.50	-1048.0	-2982.2	2470.1	-.33	-8.13	.77
0843.00	-1059.1	-3256.9	2601.0	-.36	-9.15	1.31
0843.50	-1025.1	-3484.9	2678.6	1.13	-7.60	-.46
0844.00	-969.4	-3755.4	2768.1	1.85	-9.01	-.06
0844.50	-890.8	-4043.3	2865.1	2.62	-9.59	.18
0845.00	-763.0	-4235.0	2902.5	4.25	-6.38	-1.80
0845.50	-639.9	-4457.4	2964.7	4.10	-7.41	-.97
0846.00	-541.9	-4750.7	3064.5	3.26	-9.77	.27
0846.50	-447.0	-5055.2	3159.7	3.16	-10.15	.12
0847.00	-360.3	-5397.8	3273.8	2.88	-11.41	.75
0847.50	-291.1	-5797.5	3412.7	2.30	-13.32	1.57
0848.00	-222.2	-6103.7	3493.3	2.29	-10.20	-.35
0848.50	-131.9	-6324.2	3534.3	3.01	-7.34	-1.68
0849.00	-31.5	-6748.5	3697.3	3.34	-14.47	2.38
0849.50	77.6	-7215.1	3876.2	3.64	-15.22	2.91
0850.00	202.5	-7352.2	3894.6	4.16	-4.56	-2.43

Double Theodolite Data - Shoreline Station

Time	Balloon Position			Wind Velocity		
	X	Y	Z	U	V	W
0930.00	.0	274.3	7.6			
0930.50	-120.1	274.3	98.0	-4.00	-.28	-.03
0931.00	-249.8	252.9	192.3	-4.32	-.42	.09
0931.50	-384.1	241.9	295.0	-4.47	-.36	.37
0932.00	-516.1	235.7	415.9	-4.39	-.20	.98
0932.50	-647.8	228.1	544.6	-4.38	-.25	1.24
0933.00	-777.9	203.5	663.3	-4.33	-.81	.91
0933.50	-878.8	149.3	771.1	-3.36	-1.80	.54
0934.00	-927.7	77.7	869.0	-1.63	-2.38	.21
0934.50	-944.6	8.3	958.6	-.56	-2.31	-.05
0935.00	-963.1	-60.1	1049.2	-.61	-2.28	-.02
0935.50	-988.3	-150.5	1145.2	-.84	-3.01	.15
0936.00	-1005.0	-275.4	1241.3	-.55	-4.16	.15
0936.50	-1003.7	-422.7	1332.0	.04	-4.90	-.02
0937.00	-988.0	-587.5	1425.3	.52	-5.49	.06
0937.50	-971.9	-764.7	1530.7	.53	-5.90	.46
0938.00	-963.5	-922.6	1632.5	.28	-5.26	.34
0938.50	-977.2	-1047.0	1733.9	-.45	-4.14	.33
0939.00	-1018.6	-1137.5	1837.3	-1.37	-3.01	.40
0939.50	-1065.0	-1199.8	1917.7	-1.54	-2.07	-.36
0940.00	-1114.4	-1284.2	1993.4	-1.64	-2.81	-.52
0940.50	-1173.1	-1411.5	2084.3	-1.95	-4.24	-.02
0941.00	-1271.1	-1613.3	2246.5	-3.26	-6.72	2.35
0941.50	-1364.5	-1838.8	2416.4	-3.11	-7.51	2.61
0942.00	-1372.5	-1970.0	2453.5	-.26	-4.37	-1.80
0942.50	-1372.4	-2097.3	2480.3	.00	-4.24	-2.15
0943.00	-1401.3	-2298.7	2571.7	-.96	-6.71	-.00
0943.50	-1409.3	-2527.4	2654.1	-.26	-7.62	-.30
0944.00	-1390.7	-2766.0	2720.8	.62	-7.95	-.82
0944.50	-1362.0	-3041.0	2813.7	.95	-9.16	.05
0945.00	-1334.8	-3353.2	2941.9	.90	-10.40	1.22
0945.50	-1297.2	-3624.3	3043.7	1.25	-9.06	.34
0946.00	-1260.4	-3864.1	3123.6	1.22	-7.95	-.38
0946.50	-1243.5	-4131.6	3222.5	.56	-8.91	.24
0947.00	-1234.1	-4469.2	3370.7	.31	-11.25	1.89
0947.50	-1200.7	-4828.3	3535.0	1.11	-11.97	2.42
0948.00	-1139.7	-5135.1	3651.3	2.03	-10.22	.82
0948.50	-1058.2	-5386.4	3722.3	2.71	-8.37	-.68
0949.00	-929.4	-5511.2	3720.6	4.29	-4.15	-3.10
0949.50	-767.9	-5649.2	3737.1	5.38	-4.59	-2.49
0950.00	-612.5	-6002.6	3888.0	5.18	-11.77	1.98

Double Theodolite Data - Shoreline Station

Time	Balloon Position			Wind Velocity		
	X	Y	Z	U	V	W
1000.00	.0	274.3	7.6			
1000.50	-87.8	242.2	138.5	-2.92	-1.06	1.31
1001.00	-188.9	213.5	284.8	-3.36	-.95	1.83
1001.50	-284.6	198.2	455.1	-3.19	-.50	2.62
1002.00	-361.0	202.6	621.6	-2.54	.14	2.50
1002.50	-424.0	228.4	751.2	-2.10	.85	1.27
1003.00	-473.9	256.7	856.4	-1.66	.94	.45
1003.50	-512.7	258.0	969.5	-1.29	.04	.72
1004.00	-538.7	217.8	1080.0	-.86	-1.34	.63
1004.50	-548.3	133.5	1163.2	-.32	-2.80	-.27
1005.00	-559.3	19.0	1248.0	-.36	-3.81	-.21
1005.50	-579.7	-109.5	1349.6	-.67	-4.28	.33
1006.00	-601.2	-243.2	1447.2	-.71	-4.45	.20
1006.50	-623.7	-367.4	1540.4	-.74	-4.13	.05
1007.00	-648.9	-466.2	1636.3	-.84	-3.29	.15
1007.50	-682.2	-526.6	1732.3	-1.10	-2.01	.15
1008.00	-732.7	-569.2	1820.9	-1.68	-1.42	-.09
1008.50	-802.2	-641.9	1907.0	-2.31	-2.42	-.17
1009.00	-883.9	-751.5	1997.1	-2.72	-3.65	-.04
1009.50	-973.1	-885.5	2096.2	-2.97	-4.46	.25
1010.00	-1059.4	-1046.1	2205.0	-2.87	-5.35	.57
1010.50	-1133.2	-1226.5	2310.4	-2.45	-6.01	.46
1011.00	-1200.6	-1404.1	2412.6	-2.24	-5.91	.35
1011.50	-1266.0	-1580.5	2520.4	-2.18	-5.88	.54
1012.00	-1319.8	-1770.3	2618.1	-1.79	-6.32	.20
1012.50	-1358.3	-1978.7	2704.2	-1.28	-6.94	-.18
1013.00	-1397.6	-2241.3	2832.8	-1.30	-8.75	1.23
1013.50	-1404.4	-2510.9	2959.4	-.22	-8.98	1.17
1014.00	-1350.7	-2719.7	3015.5	1.79	-6.96	-1.18
1014.50	-1310.4	-2959.7	3109.6	1.34	-8.00	.08
1015.00	-1314.2	-3247.9	3259.0	-.12	-9.60	1.93
1015.50	-1303.6	-3499.0	3358.3	.35	-8.37	.26
1016.00	-1262.2	-3747.3	3439.7	1.38	-8.27	-.33
1016.50	-1211.1	-4018.0	3533.3	1.70	-9.02	.07
1017.00	-1138.8	-4234.9	3571.3	2.40	-7.22	-1.78
1017.50	-1051.4	-4484.1	3633.7	2.91	-8.30	-.96
1018.00	-971.2	-4890.9	3828.8	2.67	-13.55	3.45
1018.50	-857.8	-5233.7	3981.1	3.77	-11.42	2.02
1019.00	-688.4	-5342.1	3960.9	5.64	-3.61	-3.72
1019.50	-503.3	-5441.7	3937.4	6.16	-3.32	-3.83
1020.00	-333.1	-5732.1	4050.2	5.67	-9.67	.70

Double Theodolite Data - Shoreline Station

Time	Balloon Position			Wind Velocity		
	X	Y	Z	U	V	W
1030.00	.0	274.3	7.6			
1030.50	-59.7	244.7	124.6	-1.99	-.98	.85
1031.00	-137.5	199.7	254.2	-2.59	-1.50	1.27
1031.50	-218.3	157.4	383.9	-2.69	-1.41	1.27
1032.00	-287.2	121.2	508.1	-2.29	-1.20	1.09
1032.50	-352.2	93.0	634.7	-2.16	-.93	1.17
1033.00	-429.1	86.6	772.5	-2.56	-.21	1.54
1033.50	-515.0	92.2	917.5	-2.86	.18	1.78
1034.00	-586.7	77.9	1042.1	-2.39	-.47	1.10
1034.50	-638.6	30.2	1136.1	-1.72	-1.58	.08
1035.00	-685.6	-41.2	1223.3	-1.56	-2.38	-.14
1035.50	-736.4	-116.6	1317.8	-1.69	-2.51	.10
1036.00	-794.4	-189.0	1436.3	-1.93	-2.41	.90
1036.50	-844.0	-261.4	1559.0	-1.65	-2.41	1.04
1037.00	-875.7	-315.0	1652.4	-1.05	-1.78	.06
1037.50	-918.0	-343.1	1742.9	-1.40	-.93	-.03
1038.00	-985.8	-373.2	1835.7	-2.26	-1.00	.04
1038.50	-1075.9	-431.0	1925.0	-3.00	-1.92	-.07
1039.00	-1178.8	-513.0	2016.3	-3.43	-2.73	-.00
1039.50	-1283.1	-609.6	2109.8	-3.47	-3.22	.06
1050.00	-1385.3	-728.4	2212.5	-3.40	-3.96	.37
1040.50	-1481.8	-868.4	2318.0	-3.21	-4.66	.46
1041.00	-1574.6	-1015.1	2421.3	-3.09	-4.88	.39
1041.50	-1666.5	-1169.5	2521.8	-3.06	-5.14	.30
1042.00	-1755.5	-1340.2	2617.7	-2.96	-5.68	.14
1042.50	-1845.4	-1537.4	2728.5	-2.99	-6.57	.64
1043.00	-1917.0	-1763.6	2854.5	-2.38	-7.54	1.15
1043.50	-1942.1	-1994.6	2961.0	-.83	-7.69	.50
1044.00	-1941.8	-2219.3	3049.7	.00	-7.49	-.09
1044.50	-1978.5	-2490.9	3192.3	-1.22	-9.05	1.70
1045.00	-2029.7	-2768.2	3347.1	-1.70	-9.24	2.11
1045.50	-2004.5	-2937.6	3380.3	.83	-5.64	-1.94
1046.00	-1964.9	-3106.3	3402.8	1.31	-5.62	-2.29
1046.50	-1979.6	-3380.4	3534.5	-.48	-9.13	1.34
1047.00	-1968.3	-3655.1	3659.5	.37	-9.15	1.12
1047.50	-1882.9	-3854.5	3703.4	2.84	-6.64	-1.58
1048.00	-1767.5	-5067.4	3754.3	3.84	-7.09	-1.34
1048.50	-1663.4	-4372.9	3884.5	3.46	-10.18	1.29
1049.00	-1540.4	-4666.1	4002.9	4.10	-9.77	.89
1049.50	-1388.1	-4934.1	4086.3	5.07	-8.93	-.26
1050.00	-1251.0	-5306.3	4241.8	4.57	-12.40	2.13

Double Theodolite Data - Shoreline Station

Time	Balloon Position			Wind Velocity		
	X	Y	Z	U	V	W
1100.00	.0	274.3	7.6			
1100.50	10.4	219.4	137.1	.34	-1.82	1.26
1101.00	-13.2	167.0	272.0	-.79	-1.74	1.44
1101.50	-82.7	131.0	430.1	-2.31	-1.20	2.22
1102.00	-165.4	114.6	587.2	-2.75	-.54	2.18
1102.50	-240.1	99.7	723.7	-2.49	-.49	1.50
1103.00	-316.7	59.0	863.2	-2.55	-1.35	1.60
1103.50	-406.7	4.7	1003.1	-2.99	-1.81	1.61
1104.00	-501.5	-35.0	1119.4	-3.16	-1.32	.82
1104.50	-580.0	-66.8	1211.4	-2.61	-1.06	.01
1105.00	-644.4	-109.2	1289.4	-2.14	-1.41	-.44
1105.50	-701.8	-162.6	1369.9	-1.91	-1.77	-.36
1106.00	-750.8	-215.7	1464.4	-1.63	-1.77	.10
1106.50	-794.4	-253.3	1559.0	-1.45	-1.25	.10
1107.00	-835.5	-266.3	1646.5	-1.37	-.43	-.13
1107.50	-867.7	-253.4	1723.7	-1.07	.42	-.47
1108.00	-906.2	-238.5	1804.8	-1.28	.49	-.34
1108.50	-984.1	-261.6	1910.4	-2.59	-.77	.47
1109.00	-1087.8	-321.4	2009.7	-3.45	-1.99	.26
1109.50	-1195.5	-392.8	2094.6	-3.58	-2.38	-.21
1110.00	-1306.4	-472.0	2182.4	-3.69	-2.63	-.12
1110.50	-1421.5	-565.2	2270.6	-3.83	-3.10	-.10
1111.00	-1547.7	-671.0	2364.2	-4.20	-3.52	.07
1111.50	-1678.7	-792.4	2475.1	-4.36	-4.04	.64
1112.00	-1811.1	-940.9	2607.7	-4.41	-4.94	1.37
1112.50	-1935.7	-1108.0	2733.3	-4.15	-5.56	1.13
1113.00	-2030.1	-1272.9	2824.1	-3.14	-5.49	-.02

Double Theodolite Data - Shoreline Station

Time	Balloon Position			Wind Velocity		
	X	Y	Z	U	V	W
1130.00	.0	274.3	7.6			
1130.50	84.5	250.6	127.2	2.81	-.78	.94
1131.00	138.8	213.5	247.4	1.81	-1.23	.95
1131.50	144.4	179.0	364.4	.18	-1.14	.85
1132.00	82.5	163.4	474.4	-2.06	-.51	.62
1132.50	-13.0	157.3	581.1	-3.18	-.20	.50
1133.00	-108.6	151.2	687.7	-3.18	-.20	.50
1133.50	-204.3	145.1	794.3	-3.18	-.20	.50
1134.00	-299.9	139.0	901.0	-3.18	-.20	.50
1134.50	-395.5	132.9	1007.6	-3.18	-.20	.50
1135.00	-491.1	126.8	1114.2	-3.18	-.20	.50
1135.50	-586.1	114.4	1228.1	-3.16	-.41	.74
1136.00	-674.0	84.4	1348.7	-2.93	-1.00	.97
1136.50	-736.3	44.3	1462.1	-2.07	-1.33	.73
1137.00	-766.1	18.5	1566.1	-.99	-.85	.42
1137.50	-784.1	15.8	1663.8	-.60	-.09	.20
1138.00	-806.4	29.1	1761.4	-.74	.44	.20
1138.50	-839.1	49.9	1858.3	-1.08	.69	.18
1139.00	-895.3	60.2	1944.8	-1.87	.34	-.16
1139.50	-983.9	43.5	2035.1	-2.95	-.55	-.03
1140.00	-1097.0	8.3	2133.4	-3.76	-1.17	.22
1140.50	-1213.1	-30.8	2212.3	-3.86	-1.30	-.41
1141.00	-1331.4	-79.2	2278.0	-3.94	-1.61	-.85
1141.50	-1473.2	-151.0	2367.3	-4.72	-2.39	-.07
1142.00	-1614.4	-245.4	2466.8	-4.70	-3.14	.26
1142.50	-1741.0	-353.4	2555.6	-4.21	-3.59	-.08
1143.00	-1884.2	-473.5	2653.3	-4.77	-4.00	.21
1143.50	-2013.6	-601.2	2736.2	-4.31	-4.25	-.28
1144.00	-2111.4	-746.2	2805.9	-3.25	-4.83	-.72
1144.50	-2210.2	-918.6	2906.1	-3.29	-5.74	.29
1145.00	-2288.6	-1095.6	3014.6	-2.61	-5.89	.56
1145.50	-2328.8	-1252.9	3106.2	-1.34	-5.24	.00
1146.00	-2360.4	-1390.3	3192.1	-1.05	-4.58	-.18
1146.50	-2391.7	-1529.6	3276.3	-1.04	-4.64	-.24
1147.00	-2401.1	-1677.3	3335.0	-.31	-4.92	-1.08
1147.50	-2415.7	-1844.0	3390.0	-.48	-5.55	-1.21
1148.00	-2472.2	-2060.8	3493.5	-1.88	-7.22	.40
1148.50	-2518.1	-2294.7	3603.9	-1.53	-7.79	.63
1149.00	-2535.2	-2527.5	3717.7	-.56	-7.76	.74
1149.50	-2585.0	-2808.9	3909.2	-1.66	-9.38	3.33

Double Theodolite Data - Shoreline Station

Time	Balloon Position			Wind Velocity		
	X	Y	Z	U	V	W
1330.00	.0	274.3	7.6			
1330.50	92.1	154.2	105.3	3.07	-4.00	.21
1331.00	185.9	49.1	199.0	3.12	-3.50	.07
1331.50	253.8	-28.5	293.6	2.26	-2.58	.10
1332.00	257.9	-69.4	395.0	.13	-1.36	.33
1332.50	197.3	-78.2	499.7	-2.02	-.29	.44
1333.00	99.2	-71.3	599.2	-3.26	.22	.26
1333.50	-17.0	-64.7	691.3	-3.87	.22	.02
1334.00	-139.4	-61.1	780.7	-4.07	.11	-.06
1334.50	-261.7	-57.6	870.2	-4.07	.11	-.06
1335.00	-384.1	-54.1	959.6	-4.07	.11	-.06
1335.50	-520.5	-43.6	1053.1	-4.54	.35	.06
1336.00	-685.6	-15.7	1151.9	-5.50	.92	.24
1336.50	-868.8	21.3	1248.5	-6.10	1.23	.17
1337.00	-1058.0	53.2	1340.6	-6.30	1.06	.02
1337.50	-1248.9	83.9	1428.4	-6.36	1.02	-.12
1338.00	-1427.1	118.7	1511.0	-5.93	1.15	-.29
1338.50	-1565.6	157.9	1602.0	-4.61	1.30	-.01
1339.00	-1658.1	205.9	1711.8	-3.08	1.59	.61
1339.50	-1715.1	265.5	1816.7	-1.90	1.98	.44
1340.00	-1759.8	330.3	1907.2	-1.48	2.16	-.02
1340.50	-1829.6	386.4	2005.2	-2.32	1.87	.21
1341.00	-1927.3	425.6	2109.3	-3.25	1.30	.42
1341.50	-2037.1	438.7	2200.7	-3.66	.43	-.00
1342.00	-2166.9	435.9	2290.8	-4.32	-.09	-.04
1342.50	-2317.9	437.2	2401.7	-5.03	.04	.64
1343.00	-2446.3	438.7	2505.6	-4.27	.05	.41
1343.50	-2554.3	420.5	2598.8	-3.60	-.60	.05
1344.00	-2665.0	359.8	2697.6	-3.69	-2.02	.24
1344.50	-2747.3	264.8	2798.4	-2.74	-3.16	.04
1345.00	-2790.0	156.8	2884.6	-1.42	-3.59	.09
1345.50	-2810.9	32.7	2985.6	-.69	-4.13	.32
1346.00	-2844.1	-118.4	3098.3	-1.10	-5.04	.70
1346.50	-2899.4	-291.7	3215.8	-1.84	-5.77	.86
1347.00	-2945.6	-474.8	3319.3	-1.54	-6.10	.40
1347.50	-2958.4	-659.1	3414.2	-.42	-6.14	.11
1348.00	-2932.7	-835.0	3505.3	.85	-5.86	-.01
1348.50	-2890.9	-1014.4	3596.3	1.39	-5.97	-.01
1349.00	-2843.0	-1205.8	3683.5	1.59	-6.38	-.14
1349.50	-2797.9	-1413.9	3785.9	1.50	-6.93	.36
1350.00	-2792.8	-1651.9	3951.2	.17	-7.93	2.46

Double Theodolite Data - Shoreline Station

Time	Balloon Position			Wind Velocity		
	X	Y	Z	U	V	W
1400.00	.0	274.3	7.6			
1400.50	91.0	154.2	107.3	3.03	-4.00	.27
1401.00	171.9	66.0	202.3	2.69	-2.94	.11
1401.50	201.0	6.9	300.2	.96	-1.96	.21
1402.00	161.4	-36.1	400.2	-1.31	-1.43	.28
1402.50	79.6	-66.7	493.5	-2.72	-1.01	.06
1403.00	-19.2	-87.4	577.9	-3.29	-.68	-.23
1403.50	-125.9	-113.4	667.2	-3.55	-.86	-.07
1404.00	-238.4	-156.9	773.9	-3.74	-1.45	.50
1404.50	-351.6	-205.1	888.2	-3.77	-1.60	.76
1405.00	-470.8	-239.5	997.7	-3.97	-1.14	.60
1405.50	-606.4	-254.9	1102.5	-4.51	-.51	.44
1406.00	-755.5	-252.5	1204.8	-4.96	.07	.36
1406.50	-918.0	-232.7	1299.4	-5.41	.65	.10
1407.00	-1087.3	-200.3	1386.6	-5.64	1.08	-.14
1407.50	-1235.6	-166.0	1471.3	-4.94	1.14	-.22
1408.00	-1331.8	-126.5	1558.6	-3.20	1.31	-.13
1408.50	-1372.6	-75.2	1655.4	-1.36	1.70	.17
1409.00	-1381.0	-21.7	1755.0	-.28	1.78	.27
1409.50	-1384.8	34.7	1846.7	-.12	1.88	.00
1410.00	-1413.3	102.6	1942.3	-.95	2.26	.13
1410.50	-1474.2	177.0	2047.4	-2.02	2.47	.45
1411.00	-1553.2	251.2	2149.1	-2.63	2.47	.34
1411.50	-1648.3	313.2	2247.6	-3.16	2.06	.23
1412.00	-1765.4	352.9	2354.2	-3.90	1.32	.50
1412.50	-1892.7	379.0	2469.7	-4.24	.86	.80
1413.00	-1998.0	401.2	2569.0	-3.50	.73	.26
1413.50	-2093.8	406.3	2656.7	-3.19	.17	-.12
1414.00	-2202.6	363.7	2756.1	-3.62	-1.41	.26
1414.50	-2299.0	274.4	2863.7	-3.21	-2.97	.54
1415.00	-2294.1	174.1	2892.2	.16	-3.34	-2.09
1415.50	-2225.9	56.9	2874.1	2.27	-3.90	-3.65
1416.00	-2287.4	-105.6	3023.7	-2.05	-5.42	1.93
1416.50	-2416.8	-287.1	3246.7	-4.31	-6.04	4.38
1417.00	-2474.8	-467.4	3366.8	-1.93	-6.01	.95
1417.50	-2508.8	-665.3	3474.6	-1.13	-6.59	.54
1418.00	-2524.0	-868.2	3601.1	-.50	-6.76	1.16
1418.50	-2506.5	-1068.7	3709.3	.58	-6.68	.55
1419.00	-2478.3	-1276.4	3802.0	.94	-6.92	.04
1419.50	-2436.7	-1482.8	3880.7	1.38	-6.88	-.42
1420.00	-2405.8	-1696.0	3990.1	1.03	-7.10	.60

Double Theodolite Data - Shoreline Station

Time	Balloon Position			Wind Velocity		
	X	Y	Z	U	V	W
1430.00	.0	274.3	7.6			
1430.50	99.3	121.2	108.7	3.31	-5.10	.32
1431.00	180.9	2.6	204.5	2.71	-3.95	.14
1431.50	203.8	-70.8	301.4	.76	-2.44	.17
1432.00	163.3	-109.0	402.1	-1.34	-1.27	.30
1432.50	82.0	-130.7	504.6	-2.71	-.72	.36
1433.00	-21.0	-148.5	605.7	-3.43	-.59	.32
1433.50	-139.9	-168.0	712.5	-3.96	-.64	.51
1434.00	-277.1	-184.8	829.7	-4.57	-.56	.85
1434.50	-420.8	-187.0	943.6	-4.79	-.07	.75
1435.00	-569.1	-175.9	1053.9	-4.94	.37	.62
1435.50	-733.7	-160.0	1166.9	-5.48	.53	.71
1436.00	-913.3	-142.6	1275.5	-5.98	.57	.57
1436.50	-1092.2	-116.4	1381.0	-5.96	.87	.46
1437.00	-1234.0	-61.8	1488.2	-4.72	1.81	.52
1437.50	-1305.8	22.3	1595.2	-2.39	2.80	.51
1438.00	-1332.8	114.0	1709.4	-.89	3.05	.75
1438.50	-1352.7	203.9	1823.0	-.66	2.99	.73
1439.00	-1384.3	298.2	1922.9	-1.05	3.14	.28
1439.50	-1445.0	392.3	2023.3	-2.02	3.13	.30
1440.00	-1523.8	481.1	2123.3	-2.62	2.95	.28
1440.50	-1622.2	566.1	2225.6	-3.28	2.83	.36
1441.00	-1745.3	648.5	2332.0	-4.10	2.74	.49
1441.50	-1862.1	724.9	2424.2	-3.89	2.54	.02
1442.00	-1960.4	787.1	2517.8	-3.27	2.07	.07
1442.50	-2056.7	817.6	2630.5	-3.20	1.01	.70
1443.00	-2180.0	794.5	2778.3	-4.11	-.76	1.87
1443.50	-2291.3	720.2	2930.4	-3.70	-2.47	2.02
1444.00	-2307.1	606.3	3013.0	-.52	-3.79	-.29
1444.50	-2271.8	461.2	3060.6	1.17	-4.83	-1.45
1445.00	-2272.0	298.0	3138.0	-.00	-5.43	-.46
1445.50	-2311.0	127.6	3247.2	-1.30	-5.68	.59
1446.00	-2347.1	-49.0	3360.3	-1.20	-5.88	.72
1446.50	-2353.3	-238.3	3458.9	-.20	-6.31	.23
1447.00	-2358.6	-442.5	3583.2	-.17	-6.80	1.09
1447.50	-2352.6	-651.1	3700.7	.19	-6.95	.86
1448.00	-2324.1	-860.8	3787.1	.95	-6.98	-.16
1448.50	-2312.5	-1080.4	3911.3	.38	-7.31	1.09
1449.00	-2270.2	-1285.2	4021.2	1.41	-6.82	.61
1449.50	-2159.1	-1457.5	4066.1	3.70	-5.74	-1.55
1450.00	-2024.6	-1618.2	4092.4	4.48	-5.35	-2.17

Double Theodolite Data - Shoreline Station

Time	Balloon Position			Wind Velocity		
	X	Y	Z	U	V	W
1800.00	.0	274.3	7.6			
1800.50	104.6	111.0	101.1	3.48	-5.44	.06
1801.00	193.1	-26.0	193.8	2.95	-4.56	.04
1801.50	229.2	-105.9	285.0	1.20	-2.66	-.00
1802.00	205.8	-150.5	375.8	-.77	-1.48	-.02
1802.50	151.6	-188.5	468.1	-1.80	-1.26	.03
1803.00	82.1	-218.0	563.5	-2.31	-.98	.13
1803.50	3.5	-233.3	662.4	-2.62	-.51	.24
1804.00	-81.7	-232.3	758.2	-2.84	.03	.14
1804.50	-185.1	-219.7	851.3	-3.44	.42	.05
1805.00	-310.9	-206.1	949.9	-4.19	.45	.23
1805.50	-452.8	-190.8	1050.0	-4.72	.50	.29
1806.00	-605.7	-166.6	1146.7	-5.09	.80	.17
1806.50	-763.6	-136.4	1239.1	-5.26	1.00	.02
1807.00	-922.6	-102.3	1329.1	-5.29	1.13	-.04
1807.50	-1085.2	-61.9	1422.5	-5.41	1.34	.06
1808.00	-1251.8	-16.3	1516.2	-5.55	1.51	.07
1808.50	-1409.9	38.2	1604.8	-5.27	1.81	-.09
1809.00	-1551.5	106.0	1692.0	-4.71	2.26	-.14

Double Theodolite Data - Shoreline Station

Time	Balloon Position			Wind Velocity		
	X	Y	Z	U	V	W
1830.00	.0	274.3	7.6			
1830.50	57.4	123.1	106.3	1.91	-5.03	.24
1831.00	98.4	30.7	203.8	1.36	-3.08	.20
1831.50	86.3	-13.5	296.0	-.40	-1.47	.02
1832.00	30.6	-42.0	384.1	-1.85	-.95	-.11
1832.50	-43.6	-66.9	477.7	-2.47	-.82	.07
1833.00	-131.2	-81.7	577.5	-2.91	-.49	.27
1833.50	-226.3	-80.4	679.2	-3.16	.04	.34
1834.00	-324.4	-66.6	788.1	-3.27	.45	.58
1834.50	-419.0	-46.9	895.6	-3.15	.65	.53
1835.00	-512.9	-24.5	988.1	-3.13	.74	.03
1835.50	-617.9	-.8	1079.9	-3.50	.78	.01
1836.00	-735.2	23.3	1176.6	-3.90	.80	.17
1836.50	-863.3	51.8	1268.3	-4.26	.95	.00
1837.00	-1008.5	86.9	1356.7	-4.84	1.16	-.10
1837.50	-1174.9	125.2	1448.1	-5.54	1.27	.00
1838.00	-1330.0	169.2	1542.3	-5.17	1.46	.09
1838.50	-1440.5	235.3	1650.8	-3.68	2.20	.56
1839.00	-1488.4	335.1	1776.8	-1.59	3.32	1.14
1839.50	-1453.8	454.0	1888.6	1.15	3.96	.68
1840.00	-1379.4	570.6	1990.7	2.48	3.88	.35
1840.50	-1318.5	682.7	2097.7	2.02	3.73	.51
1841.00	-1270.1	795.9	2193.3	1.61	3.77	.13
1841.50	-1234.7	889.8	2275.1	1.17	3.13	-.32
1842.00	-1234.2	951.2	2367.7	.01	2.04	.04
1842.50	-1272.8	985.2	2482.2	-1.28	1.13	.76
1843.00	-1310.4	978.7	2584.4	-1.25	-.21	.35
1843.50	-1316.6	929.7	2661.2	-.20	-1.63	-.48
1844.00	-1322.0	870.7	2764.6	-.18	-1.96	.39
1844.50	-1342.2	821.4	2905.0	-.67	-1.64	1.63
1845.00	-1342.0	766.6	3028.4	.00	-1.82	1.06
1845.50	-1324.9	703.7	3142.4	.56	-2.09	.75
1846.00	-1313.8	644.6	3266.5	.37	-1.97	1.09
1846.50	-1304.0	589.9	3384.5	.32	-1.82	.88
1847.00	-1288.6	539.0	3502.8	.51	-1.69	.89
1847.50	-1262.7	490.6	3636.1	.86	-1.61	1.39
1848.00	-1216.2	435.1	3766.2	1.55	-1.84	1.28
1848.50	-1147.1	367.9	3876.6	2.30	-2.24	.62
1849.00	-1078.2	294.9	4003.0	2.29	-2.43	1.16
1849.50	-1005.5	217.7	4135.3	2.42	-2.57	1.36
1850.00	-906.0	136.2	4224.3	3.31	-2.71	-.08

Double Theodolite Data - Shoreline Station

Time	Balloon Position			Wind Velocity		
	X	Y	Z	U	V	W
1900.00	.0	274.3	7.6			
1900.50	10.8	171.9	105.8	.36	-3.41	.22
1901.00	-22.5	102.8	197.0	-1.11	-2.30	-.00
1901.50	-101.6	63.2	286.3	-2.63	-1.32	-.07
1902.00	-204.1	37.9	375.1	-3.41	-.84	-.08
1902.50	-317.4	19.1	462.5	-3.77	-.62	-.13
1903.00	-435.2	3.4	549.1	-3.92	-.52	-.16
1903.50	-553.6	-9.2	635.3	-3.94	-.42	-.17
1904.00	-673.1	-18.9	721.2	-3.98	-.32	-.18
1904.50	-797.1	-28.3	808.2	-4.13	-.31	-.14
1905.00	-949.0	-35.8	915.7	-5.06	-.25	.53
1905.50	-1106.6	-32.9	1026.1	-5.25	.09	.63
1906.00	-1224.0	-13.8	1099.3	-3.91	.63	-.60
1906.50	-1342.7	13.7	1167.7	-3.95	.91	-.76
1907.00	-1490.4	40.1	1255.3	-4.92	.88	-.12
1907.50	-1631.5	75.6	1354.1	-4.70	1.18	.24
1908.00	-1718.0	137.1	1453.0	-2.88	2.04	.24
1908.50	-1739.8	221.1	1538.7	-.72	2.80	-.19
1909.00	-1720.1	325.4	1622.5	.65	3.47	-.25
1909.50	-1663.4	451.5	1711.8	1.89	4.20	-.07
1910.00	-1583.2	581.7	1806.8	2.67	4.34	.12
1910.50	-1501.0	700.3	1903.9	2.74	3.95	.18
1911.00	-1430.2	807.6	1995.0	2.36	3.57	-.01
1911.50	-1369.2	912.3	2077.6	2.03	3.49	-.29
1912.00	-1307.7	999.5	2131.5	2.05	2.90	-1.25
1912.50	-1289.0	1073.7	2205.1	.62	2.47	-.59
1913.00	-1349.8	1150.9	2347.5	-2.02	2.57	1.69
1913.50	-1422.0	1183.5	2459.4	-2.40	1.08	.68
1914.00	-1484.8	1165.9	2544.6	-2.09	-.58	-.20
1914.50	-1555.8	1127.6	2658.4	-2.36	-1.27	.74
1915.00	-1603.6	1070.8	2750.3	-1.59	-1.89	.01
1915.50	-1645.8	1023.2	2846.3	-1.40	-1.58	.15
1916.00	-1676.0	987.2	2948.4	-1.00	-1.19	.35
1916.50	-1665.6	943.4	3016.4	.34	-1.46	-.78
1917.00	-1643.3	897.9	3080.6	.74	-1.51	-.90
1917.50	-1628.9	858.5	3162.4	.47	-1.31	-.32
1918.00	-1626.3	826.1	3264.5	.08	-1.07	.35
1918.50	-1622.1	798.4	3369.2	.14	-.92	.44
1919.00	-1592.9	770.8	3457.7	.97	-.91	-.09
1919.50	-1541.4	738.7	3547.3	1.71	-1.06	-.06
1920.00	-1479.1	700.8	3646.2	2.07	-1.26	.24

Double Theodolite Data - Shoreline Station

Time	Balloon Position			Wind Velocity		
	X	Y	Z	U	V	W
1945.00	.0	274.3	7.6			
1945.50	-45.6	190.9	95.3	-1.52	-2.77	-.12
1946.00	-133.5	121.8	185.4	-2.93	-2.30	-.04
1946.50	-263.9	74.5	280.8	-4.34	-1.57	.13
1947.00	-408.8	44.7	375.9	-4.82	-.99	.12
1947.50	-550.8	31.7	463.8	-4.73	-.43	-.11
1948.00	-686.4	33.9	546.8	-4.51	.07	-.28
1948.50	-819.0	46.2	630.1	-4.42	.40	-.27
1949.00	-957.9	67.8	715.9	-4.62	.72	-.19
1949.50	-1105.2	100.4	801.3	-4.91	1.08	-.20
1950.00	-1259.0	139.3	886.2	-5.12	1.29	-.21
1950.50	-1419.8	175.8	973.8	-5.35	1.21	-.12
1951.00	-1590.1	207.6	1064.5	-5.67	1.06	-.02
1951.50	-1765.2	238.3	1160.8	-5.83	1.02	.16
1952.00	-1905.9	275.5	1255.7	-4.69	1.23	.11
1952.50	-1991.1	331.8	1348.3	-2.83	1.87	.04
1953.00	-2042.7	417.2	1453.7	-1.71	2.84	.46
1953.50	-2051.7	537.2	1563.0	-.29	3.99	.59
1954.00	-2005.5	688.1	1661.2	1.53	5.02	.22
1954.50	-1927.8	845.5	1742.7	2.59	5.24	-.33
1955.00	-1837.1	987.1	1811.5	3.02	4.72	-.75
1955.50	-1754.1	1103.6	1886.9	2.76	3.88	-.53
1956.00	-1685.6	1196.2	1963.9	2.28	3.08	-.47
1956.50	-1613.8	1275.7	2021.3	2.39	2.65	-1.13
1957.00	-1570.6	1355.4	2087.3	1.43	2.65	-.84
1957.50	-1591.0	1431.4	2185.7	-.67	2.53	.23
1958.00	-1648.4	1481.5	2282.0	-1.91	1.66	.16
1958.50	-1725.9	1505.8	2372.6	-2.58	.81	-.02
1959.00	-1806.6	1501.7	2463.9	-2.69	-.13	-.00
1959.50	-1861.8	1458.5	2539.8	-1.83	-1.44	-.51
1960.00	-1896.7	1396.8	2610.1	-1.16	-2.05	-.70
1960.50	-1927.7	1343.8	2688.9	-1.03	-1.76	-.42
1961.00	-1952.1	1306.9	2782.0	-.81	-1.23	.05
1961.50	-1961.4	1276.8	2888.2	-.30	-1.00	.49
1962.00	-1951.5	1245.7	2991.9	.33	-1.03	.40
1962.50	-2040.9	1286.0	3262.6	-2.97	1.34	5.97
1963.00	-2121.1	1327.9	3518.1	-2.67	1.39	5.46
1963.50	-1965.0	1233.3	3407.7	5.20	-3.15	-6.72
1964.00	-1804.2	1146.6	3305.9	5.35	-2.89	-6.44
1964.50	-1757.1	1135.5	3404.4	1.56	-.37	.23
1965.00	-1711.3	1128.2	3532.8	1.52	-.24	1.23

Double Theodolite Data - Shoreline Station

Time	Balloon Position			Wind Velocity		
	X	Y	Z	U	V	W
2030.00	.0	274.3	7.6			
2030.50	-122.9	218.6	94.7	-4.09	-1.85	-.14
2031.00	-259.7	171.9	183.5	-4.56	-1.55	-.08
2031.50	-422.8	149.4	275.2	-5.43	-.74	.01
2032.00	-596.4	152.4	368.4	-5.78	.09	.05
2032.50	-764.5	172.1	462.0	-5.60	.65	.07
2033.00	-930.1	206.7	551.7	-5.52	1.15	-.05
2033.50	-1103.1	254.7	633.4	-5.76	1.59	-.32
2034.00	-1289.5	305.7	715.9	-6.21	1.70	-.29
2034.50	-1491.7	353.0	808.1	-6.74	1.57	.02
2035.00	-1702.8	396.5	903.0	-7.03	1.45	.11
2035.50	-1915.5	432.5	992.4	-7.08	1.19	-.06
2036.00	-2115.0	464.7	1081.5	-6.64	1.07	-.07
2036.50	-2284.6	502.3	1177.0	-5.65	1.24	.13

Single Theodolite Data - Shoreline Station

Time	Balloon Position			Wind Velocity		
	X	Y	Z	U	V	VT
1230.00	.0	1000.0	.0			
1230.50	94.2	167.9	91.4	3.14	-27.73	27.91
1231.00	207.3	136.1	182.8	3.76	-1.05	3.91
1231.50	272.3	87.4	274.3	2.16	-1.62	2.70
1232.00	281.2	28.5	365.7	.29	0.196	1.98
1232.50	258.5	8.1	457.2	-.75	-.68	1.01
1233.00	189.7	9.2	548.6	-2.29	.03	2.29
1233.50	103.9	13.1	640.0	-2.85	.12	2.86
1234.00	82.5	-44.2	731.5	-.71	-1.91	2.04
1234.50	-2.6	-101.4	822.9	-2.84	-1.90	3.42
1235.00	-87.9	-158.6	914.4	-2.84	-1.90	3.42
1235.50	-173.1	-215.8	1005.8	-2.84	-1.90	3.42
1236.00	-258.3	-273.1	1097.2	-2.84	-1.90	3.42
1236.50	-343.6	-330.3	1188.7	-2.84	-1.90	3.42
1237.00	-428.8	-387.5	1280.1	-2.84	-1.90	3.42
1237.50	-552.9	-427.3	1371.6	-4.13	-1.32	4.34
1238.00	-686.5	-444.1	1463.0	-4.45	- .55	4.48
1238.50	-806.1	-486.2	1554.4	-3.98	-1.40	4.22
1239.00	-890.3	-465.4	1645.9	-2.80	.69	2.89
1239.50	-940.6	-452.6	1737.3	-1.67	.42	1.72
1240.00	-971.6	-444.8	1828.8	-1.03	.26	1.06
1240.50	-978.3	-419.3	1920.2	- .22	.85	.88
1241.00	-1006.1	-376.1	2011.6	- .92	1.43	1.71
1241.50	-1083.9	-343.8	2103.1	-2.59	1.07	2.80
1242.00	-1178.1	-322.3	2194.5	-3.14	.71	3.22
1242.50	-1291.1	-298.0	2286.0	-3.76	.80	3.85
1243.00	-1431.6	-299.0	2377.4	-4.68	- .03	4.68
1243.50	-1555.1	-336.2	2468.8	-4.11	-1.23	4.29
1244.00	-1684.8	-407.5	2560.3	-4.32	-2.37	4.93
1244.50	-1839.9	-438.3	2651.7	-5.17	-1.02	5.27
1245.00	-1974.5	-470.3	2743.2	-4.48	-1.06	4.61
1245.50	-2100.9	-562.9	2834.6	-4.21	-3.08	5.22
1246.00	-2205.1	-691.0	2926.0	-3.47	-4.26	5.50
1246.50	-2282.7	-821.8	3017.5	-2.58	-4.35	5.06
1247.00	-2314.2	-968.0	3108.9	-1.05	-4.87	4.98
1247.50	-2309.0	-1071.8	3200.4	.17	-3.45	3.46
1248.00	-2314.3	-1184.2	3291.8	- .17	-3.74	3.75
1248.50	-2301.0	-1339.2	3383.2	.44	-5.16	5.18
1249.00	-2299.1	-1516.0	3474.7	.06	-5.89	5.89
1249.50	-2334.5	-1690.4	3566.1	-1.17	-5.81	5.93
1250.00	-2371.3	-1879.4	3657.6	-1.22	-6.29	6.41

Single Theodolite Data - Shoreline Station

Time	Balloon Position			Wind Velocity		
	X	Y	Z	U	V	VT
1300.00	.0	.0	.0			
1300.50	89.0	- 93.5	91.4	2.96	-3.11	4.30
1301.00	233.2	-184.2	182.8	4.80	-3.02	5.67
1301.50	343.4	-276.1	274.3	3.67	-3.06	4.78
1302.00	376.8	-331.0	365.7	1.11	-1.82	2.14
1302.50	363.9	-351.4	457.2	-.42	-.68	.80
1303.00	342.0	-385.2	548.6	-.73	-1.12	1.34
1303.50	266.7	-395.5	640.0	-2.50	-.34	2.53
1304.00	198.5	-399.9	731.5	-2.27	-.14	2.27
1304.50	129.4	-431.5	822.9	-2.30	-1.05	2.53
1305.00	32.2	-419.3	914.4	-3.24	.40	3.26
1305.50	-124.5	-431.3	1005.8	-5.22	- .40	5.24
1306.00	-281.4	-443.3	1097.2	-5.22	- .40	5.24
1306.50	-438.2	-455.4	1188.7	-5.22	- .40	5.24
1307.00	-598.8	-460.4	1280.1	-5.35	- .16	5.35
1307.50	-759.4	-465.3	1371.6	-5.35	- .16	5.35
1308.00	-852.4	-443.7	1463.0	-3.09	.72	3.18
1308.50	-995.2	-430.6	1554.4	-4.75	.43	4.77
1309.00	-1034.3	-403.2	1645.9	-1.30	.91	1.59
1309.50	-1058.8	-377.0	1737.3	- .81	.87	1.19
1310.00	-1131.0	-332.9	1828.8	-2.40	1.46	2.82
1310.50	-1203.3	-288.8	1920.2	-2.40	1.46	2.82
1311.00	-1316.5	-258.2	2011.6	-3.77	1.02	3.90
1311.50	-1461.9	-252.5	2103.1	-4.84	19	4.85
1312.00	-1608.8	-260.5	2194.5	-4.89	- .26	4.90
1312.50	-1731.0	-283.4	2286.0	-4.07	- .76	4.14
1313.00	-1840.7	-248.8	2377.4	-3.65	1.15	3.83
1313.50	-1946.5	-259.7	2468.8	-3.52	- .36	3.54
1314.00	-2038.7	-333.8	2560.3	-3.07	-2.47	3.94
1314.50	-2111.7	-429.6	2651.7	-2.43	-3.19	4.01
1315.00	-2140.0	-533.5	2743.2	- .94	-3.46	3.59
1315.50	-2135.4	-616.3	2834.6	.15	-2.75	2.76
1316.00	-2137.0	-739.9	2926.0	- .05	-4.12	4.12
1316.50	-2146.9	-889.2	3017.5	- .32	-4.97	4.98
1317.00	-2186.8	-1057.1	3108.9	-1.33	-5.59	5.75
1317.50	-2224.9	-1218.1	3200.4	-1.27	-5.36	5.51
1318.00	-2251.8	-1390.7	3291.8	- .89	-5.75	5.82
1318.50	-2238.9	-1561.9	3383.2	.42	-5.70	5.72
1319.00	-2212.3	-1722.2	3474.7	.88	-5.34	5.41
1319.50	-2150.1	-1881.5	3566.1	2.07	-5.30	5.70
1320.00	-2097.5	-2061.1	3657.6	1.75	-5.98	6.23

Single Theodolite Data - Shoreline Station

Time	Balloon Position			Wind Velocity		
	X	Y	Z	U	V	VT
1500.00	.0	1000.0	.0			
1500.50	91.5	96.5	91.4	3.05	-30.11	30.27
1501.00	237.8	- 14.5	182.8	4.87	- 3.70	6.12
1501.50	330.6	- 97.9	274.3	3.09	- 2.77	4.15
1502.00	313.2	- 149.4	365.7	- .57	- 1.71	1.81
1502.50	262.1	- 193.9	457.2	-1.70	- 1.48	2.26
1503.00	185.4	- 217.1	548.6	-2.55	- .77	2.66
1503.50	101.4	- 244.9	640.0	-2.80	- .92	2.94
1504.00	2.3	- 273.4	731.5	-3.30	- .95	3.43
1504.50	- 118.8	- 301.6	822.9	-4.03	- .93	4.14
1505.00	- 267.5	- 294.0	9.4.4	-4.95	.25	4.96
1505.50	- 420.2	- 285.5	1005.8	-5.08	.28	5.09
1506.00	- 603.2	- 266.0	1097.2	-6.10	.65	6.13
1506.50	- 802.6	- 231.6	1188.7	-6.64	1.14	6.74
1507.00	- 998.0	- 219.4	1280.1	-6.51	.40	6.52
1507.50	- 1192.0	- 176.0	1371.6	-6.46	1.44	6.62
1508.00	- 1354.3	- 118.4	1463.0	-5.41	1.91	5.74
1508.50	- 1479.4	- 49.0	1554.4	-4.17	2.31	4.76
1509.00	- 1550.9	18.9	1645.9	-2.38	2.26	3.28
1509.50	- 1594.9	91.9	1737.3	-1.46	2.43	2.84
1510.00	- 1645.8	202.1	1828.8	-1.69	3.67	4.04
1510.50	- 1718.0	318.4	1920.2	-2.40	3.87	4.56
1511.00	- 1780.7	450.6	2011.6	-2.09	4.40	4.87
1511.50	- 1845.7	599.7	2103.1	-2.16	4.97	5.42
1512.00	- 1934.5	731.0	2194.5	-2.96	4.37	5.28
1512.50	- 2039.1	865.6	2286.0	-3.48	4.48	5.68
1513.00	- 2126.9	1005.4	2377.4	-2.92	4.66	5.50
1513.50	- 2192.1	1097.7	2468.8	-2.17	3.07	3.76
1514.00	- 2267.4	1130.5	2560.3	-2.50	1.09	2.73
1514.50	- 2359.7	1105.4	2651.7	-3.07	- .83	3.19
1515.00	- 2446.9	1038.7	2743.2	-2.90	- 2.22	3.66
1515.50	- 2476.4	950.6	2834.6	- .98	- 2.93	3.09
1516.00	- 2481.0	830.1	2926.0	- .15	- 4.01	4.01
1516.50	- 2498.1	669.4	3017.5	- .57	- 5.35	5.38
1517.00	- 2532.8	496.9	3108.9	-1.15	- 5.74	5.86
1517.50	- 2560.2	337.0	3200.4	- .91	- 5.32	5.40
1518.00	- 2573.2	145.9	3291.8	- .43	- 6.37	6.38
1518.50	- 2586.3	- 45.1	3383.2	- .43	- 6.37	6.38
1519.00	- 2569.5	- 238.3	3474.7	- .55	- 6.44	6.46
1519.50	- 2555.6	- 429.5	3566.1	- .46	- 6.37	6.38
1520.00	- 2540.7	- 633.4	3657.6	- .49	- 6.79	6.81

Single Theodolite Data - Shoreline Station

Time	Balloon Position			Wind Velocity		
	X	Y	Z	U	V	VT
1530.00	.0	.0	.0			
1530.50	86.5	-175.9	91.4	2.88	-5.86	6.53
1531.00	206.5	-305.0	182.8	3.99	-4.30	5.87
1531.50	233.2	-361.9	274.3	.89	-1.89	2.09
1532.00	225.4	-408.3	365.7	- .26	-1.54	1.56
1532.50	171.2	-432.5	457.2	-1.80	- .80	1.97
1533.00	107.8	-439.2	548.6	-2.11	- .22	2.12
1533.50	33.4	-455.3	640.0	-2.48	- .53	2.53
1534.00	- 89.3	-441.3	731.5	-4.09	.46	4.11
1534.50	- 212.1	-427.2	822.9	-4.09	.46	4.11
1535.00	- 347.8	-428.0	914.4	-4.52	- .02	4.52
1535.50	- 477.6	-427.1	1005.8	-4.32	.03	4.32
1536.00	- 621.8	-411.5	1097.2	-4.80	.51	4.83
1536.50	- 759.7	-390.4	1188.7	-4.59	.70	4.64
1537.00	- 899.6	-367.1	1280.1	-4.66	.77	4.72
1537.50	- 960.4	-286.7	1371.6	-2.02	2.68	3.35
1538.00	-1021.2	-206.3	1463.0	-2.02	2.68	3.35
1538.50	-1082.0	-125.9	1554.4	-2.02	2.68	3.35
1539.00	-1142.8	- 45.5	1645.9	-2.02	2.68	3.35
1539.50	-1203.6	34.8	1737.3	-2.02	2.68	3.35
1540.00	-1264.4	115.2	1828.8	-2.02	2.68	3.35
1540.50	-1325.1	195.7	1920.2	-2.02	2.68	3.35
1541.00	-1386.4	302.3	2011.6	-2.04	3.55	4.09
1541.50	-1456.3	382.0	2103.1	-2.32	2.65	3.53
1542.00	-1493.0	450.7	2194.5	-1.22	2.28	2.59
1542.50	-1536.4	469.7	2286.0	-1.44	.63	1.57
1543.00	-1608.5	452.1	2377.4	-2.40	-.58	2.47
1543.50	-1637.6	393.1	2368.8	- .96	-1.96	2.19
1544.00	-1629.6	296.1	2560.3	.26	-3.23	3.24
1544.50	-1654.0	176.7	2651.7	- .81	-3.97	4.06
1545.00	-1673.7	46.7	2743.2	- .65	-4.33	4.38
1545.50	-1694.4	- 82.8	2834.6	- .68	-4.32	4.37
1546.00	-1713.6	-240.8	2926.0	- .63	-5.26	5.30
1546.50	-1713.2	-386.0	3017.5	.01	-4.84	4.84
1547.00	-1715.6	-527.7	3108.9	- .07	-4.72	4.72
1547.50	-1737.1	-584.5	3200.4	- .71	-1.89	2.02
1548.00	-1682.1	-816.8	3291.8	1.83	-7.74	7.95
1548.50	-1650.9	-953.1	3383.2	1.04	-4.54	4.66
1549.00	-1565.8	-1080.2	3474.7	2.83	-4.23	5.09
1549.50	-1459.4	-1203.6	3566.1	3.54	-4.11	5.43
1550.00	-1337.2	-1332.5	3657.6	4.07	-4.29	5.92

Single Theodolite Data - Shoreline Station

Time	Balloon Position			Wind Velocity		
	X	Y	Z	U	V	VT
1600.00	.0	1000.0	.0			
1600.50	86.1	60.3	91.4	2.87	-31.32	31.45
1601.00	222.6	72.3	182.8	4.54	- 4.42	6.34
1601.50	315.6	-167.8	274.3	3.10	- 3.18	4.44
1602.00	281.8	-217.0	365.7	-1.12	- 1.63	1.99
1602.50	227.1	-254.0	457.2	-1.82	- 1.23	2.20
1603.00	156.4	-266.6	548.6	-2.35	- .41	2.39
1603.50	63.6	-277.7	640.0	-3.09	- .37	3.11
1604.00	- 34.2	-283.1	731.5	-3.26	- .17	3.26
1604.50	- 156.8	-268.4	822.9	-4.08	.48	4.11
1605.00	- 267.9	-262.3	914.4	-3.70	.20	3.70
1605.50	- 421.4	-255.2	1005.8	-5.11	.23	5.12
1606.00	- 576.7	-236.5	1097.2	-5.17	.62	5.21
1606.50	- 713.3	-196.4	1188.7	-4.55	1.33	4.74
1607.00	- 876.7	-151.4	1280.1	-5.44	1.50	5.64
1607.50	- 1039.8	-101.9	1371.6	-5.43	1.64	5.68
1608.00	- 1170.9	- 53.1	1463.0	-4.36	1.62	4.66
1608.50	- 1231.9	12.9	1554.4	-2.03	2.20	2.99
1609.00	- 1268.6	93.1	1645.9	-1.22	2.67	2.94
1609.50	- 1318.8	194.7	1737.3	-1.67	3.38	3.77
1610.00	- 1369.0	351.5	1828.8	-1.67	5.22	5.48
1610.50	- 1388.9	491.8	1920.2	- .66	4.67	4.72
1611.00	- 1425.8	619.9	2011.6	-1.23	4.27	4.44
1611.50	- 1482.3	735.8	2103.1	-1.88	3.86	4.29
1612.00	- 1519.3	859.6	2194.5	-1.23	4.12	4.30
1612.50	- 1578.3	967.2	2286.9	-1.96	3.58	4.09
1613.00	- 1607.0	1047.6	2377.4	- .95	2.67	2.84
1613.50	- 1639.8	1118.6	2468.8	-1.09	2.36	2.60
1614.00	- 1700.5	1160.0	2560.3	-2.02	1.38	2.45
1614.50	- 1781.7	1157.0	2651.7	-2.70	- .09	2.70
1615.00	- 1832.3	1096.6	2743.2	-1.68	- 2.01	2.62
1615.50	- 1838.0	1010.5	2834.6	- .18	- 2.87	2.87
1616.00	- 1856.8	865.9	2926.0	- .62	- 4.82	4.86
1616.50	- 1894.2	765.3	3017.5	-1.24	- 3.35	3.57
1617.00	- 1913.5	643.9	3108.9	- .64	- 4.04	4.09
1617.50	- 1929.4	495.4	3200.4	- .53	- 4.95	4.98
1618.00	- 1947.8	343.4	3291.8	- .61	- 5.06	5.10
1618.50	- 1951.5	194.8	3383.2	- .12	- 4.95	4.95
1619.00	- 1957.1	54.6	3474.7	- .18	- 4.67	4.67
1619.50	- 1945.6	- 82.8	3566.1	.38	- 4.58	4.60
1620.00	- 1924.5	-215.8	3657.6	.70	- 4.43	4.48

Single Theodolite Data - Shoreline Station

Time	Balloon Position			Wind Velocity		
	X	Y	Z	U	V	VT
1630.00	.0	.0	.0			
1630.50	96.2	-168.7	91.4	3.20	-5.62	6.47
1631.00	229.5	-329.1	182.8	4.44	-5.34	6.95
1631.50	296.7	-411.4	274.3	2.23	-2.74	3.54
1632.00	258.8	-453.7	365.7	-1.26	-1.40	1.89
1632.50	193.7	-477.1	457.2	-2.16	- .77	2.30
1633.00	111.1	-481.3	548.6	-2.75	- .14	2.75
1633.50	30.2	-467.4	640.0	-2.69	.46	2.73
1634.00	- 69.9	-457.1	731.5	-3.33	.34	3.35
1634.50	-189.1	-461.1	822.9	-3.97	- .13	3.97
1635.00	-304.0	-457.6	914.4	-3.83	.11	3.83
1635.50	-438.3	-436.7	1005.8	-4.47	.69	4.52
1636.00	-586.0	-419.5	1097.2	-4.92	.57	4.95
1636.50	-745.7	-409.9	1188.7	-5.32	.31	5.33
1637.00	-899.4	-394.8	1280.1	-5.12	.50	5.14
1637.50	-1060.7	-379.7	1371.6	-5.37	.50	5.39
1638.00	-1215.1	-359.9	1463.0	-5.14	.66	5.19
1638.50	-1336.9	-301.2	1554.4	-4.05	1.95	4.50
1639.00	-1403.9	-217.3	1645.9	-2.23	2.79	3.58
1639.50	-1448.5	-108.9	1737.3	-1.48	3.61	3.90
1640.00	-1491.5	- 7.7	1828.8	-1.43	3.37	3.66
1640.50	-1507.2	108.0	1920.2	- .52	3.86	3.89
1641.00	-1537.3	232.5	2011.6	-1.00	4.14	4.26
1641.50	-1556.6	353.6	2103.1	- .64	4.03	4.09
1642.00	-1583.0	456.9	2194.5	- .88	3.44	3.55
1642.50	-1619.8	548.3	2286.0	-1.22	3.04	3.28
1643.00	-1670.4	591.6	2377.4	-1.68	1.44	2.21
1643.50	-1748.4	615.7	2468.8	-2.59	.80	2.72
1644.00	-1837.9	586.6	2560.3	-2.98	- .97	3.13
1644.50	-1862.7	544.7	2651.7	- .82	-1.39	1.62
1645.00	-1863.7	464.7	2743.2	- .03	-2.66	2.66
1645.50	-1878.7	355.0	2834.6	- .49	-3.65	3.69
1646.00	-1897.4	256.5	2926.0	- .62	-3.28	3.34
1646.50	-1901.4	153.0	3017.5	- .13	-3.45	3.45
1647.00	- 1897.3	36.4	3108.9	.13	-3.88	3.88
1647.50	-1891.0	- 79.2	3200.4	.21	-3.85	3.86
1648.00	-1877.7	-167.5	3291.8	.44	-2.94	2.97
1648.50	-1862.6	-325.0	3383.2	.50	-5.25	5.27
1649.00	-1829.8	-425.8	3474.7	1.09	-3.35	3.53
1649.50	-1770.7	-541.1	3566.1	1.97	-3.84	4.32
1650.00	-1702.4	-653.5	3657.5	2.27	-3.74	4.38

Single Theodolite Data - Shoreline Station

Time	Balloon Position			Wind Velocity		
	X	Y	Z	U	V	VT
1700.00	.0	1000.0	.0			
1700.50	78.3	59.0	91.4	2.61	-31.36	31.47
1701.00	212.2	- 77.2	182.8	4.46	- 4.54	6.36
1701.50	248.8	-153.0	274.3	1.21	- 2.52	2.80
1702.00	201.6	-200.9	365.7	-1.57	- 1.59	2.24
1702.50	154.9	-238.6	457.2	-1.55	- 1.25	2.00
1703.00	99.9	-270.1	548.6	-1.83	- 1.04	2.11
1703.50	30.3	-288.7	640.0	-2.31	- .62	2.40
1704.00	- 50.0	-298.8	731.5	-2.67	- .33	2.69
1704.50	-139.8	-305.3	822.9	-2.99	- .21	3.00
1705.00	-260.1	-298.1	914.4	-4.01	- .23	4.01
1705.50	-374.5	-282.2	1005.8	-3.81	.53	3.85
1706.00	-518.1	-257.2	1097.2	-4.78	.83	4.85
1706.50	-657.1	-241.7	1188.6	-4.63	.51	4.66
1707.00	-803.3	-213.7	1280.1	-4.87	.93	4.96
1707.50	-958.1	-179.2	1371.6	-5.15	1.15	5.28
1708.00	-1125.6	-144.1	1463.0	-5.58	1.17	5.70
1708.50	-1287.4	- 90.0	1554.4	-5.39	1.80	5.68
1709.00	17.0	1395.7	1645.9			65.90
1709.50	-1439.3	93.0	1737.3			65.13
1710.00	-1479.3	244.7	1828.8	-1.33	4.38	4.58
1710.50	-1519.2	356.3	1920.2	-1.33	4.38	4.58
1711.00	-1587.4	518.8	2011.6	-2.27	5.41	5.87
1711.50	-1558.8	623.5	2103.1	.95	3.48	3.61
1712.00	-1591.5	732.0	2194.5	-1.09	3.61	3.78
1712.50	-1605.7	825.2	2286.0	- .47	3.10	3.14
1713.00	-1626.1	897.6	2377.4	- .68	2.41	2.50
1713.50	-1668.4	940.1	2468.8	-1.40	1.41	1.99
1714.00	-1737.6	931.7	2560.3	-2.30	- .27	2.32
1714.50	-1767.5	900.6	2651.6	- .99	- 1.03	1.43
1715.00	-1759.5	839.2	2743.2	.26	- 2.04	2.06
1715.50	-1769.2	762.0	2834.6	- .32	- 2.57	2.59
1716.00	-1803.2	663.7	2926.0	-1.15	- 3.27	3.47
1716.50	-1818.2	576.8	3017.5	- .48	- 2.89	2.93
1717.00	-1816.1	496.8	3108.9	.07	- 2.66	2.66
1717.50	-1803.2	403.0	3200.4	.42	- 3.12	3.15
1718.00	-1791.1	306.1	3291.8	.40	- 3.22	3.25
1718.50	-1770.1	220.4	3383.2	.70	- 2.85	2.94
1719.00	-1757.8	132.1	3474.7	.40	- 2.94	2.97
1719.50	-1717.5	55.1	3566.1	1.34	- 2.56	2.89
1720.00	-1666.5	-31.9	3657.6	1.69	- 2.90	3.36

Single Theodolite Data - Shoreline Station

Time	Balloon Position			Wind Velocity		
	X	Y	Z	U	V	VT
1730.00	.0	.0	.0			
1730.50	72.2	-185.2	91.4	2.40	-6.17	6.62
1731.00	196.3	-349.9	182.8	4.13	-5.49	6.87
1731.50	216.2	-400.0	274.3	.66	-1.66	1.79
1732.00	183.4	-419.8	365.7	-1.09	- .66	1.27
1732.50	136.0	-444.9	457.2	-1.58	- .83	1.78
1733.00	59.1	-461.5	548.6	-2.56	- .55	2.62
1733.50	- 28.6	-467.5	640.0	-2.92	- .20	2.93
1734.00	-135.2	-473.2	731.5	-3.55	- .18	3.55
1734.50	-241.8	-478.8	822.9	-3.55	- .18	3.55
1735.00	-360.6	-471.7	914.4	-3.95	.23	3.96
1735.50	-487.3	-460.8	1005.8	-4.22	.36	4.23
1736.00	-639.1	-433.6	1097.2	-5.05	.90	5.13
1736.50	-790.9	-406.4	1188.7	-5.05	.90	5.13
1737.00	-956.1	-370.8	1280.1	-5.50	1.18	5.63
1737.50	-1102.3	-330.7	1371.6	-4.87	1.33	5.05
1738.00	-1249.4	-281.5	1463.0	-4.90	1.63	5.16
1738.50	-1402.7	-217.1	1554.4	-5.10	2.14	5.54
1739.00	-1544.6	-140.6	1645.9	-4.73	2.55	5.37
1739.50	-1558.1	- 38.7	1737.3	- .45	3.39	3.42
1740.00	-1571.7	63.1	1828.8	- .45	3.39	3.42
1740.50	-1545.2	173.3	1920.2	.88	3.67	3.77
1741.00	-1521.2	292.9	2011.6	.80	3.98	4.06
1741.50	-1504.5	397.5	2103.1	.55	3.48	3.53
1742.00	-1487.3	468.9	2194.5	-.57	2.38	2.44
1742.50	-1507.8	519.2	2286.0	- .68	1.67	1.80
1743.00	-1541.1	542.7	2377.4	-1.11	.78	1.36
1743.50	-1541.5	507.0	2468.8	- .01	1.18	1.18
1744.00	-1541.8	471.4	2560.3	- .01	1.18	1.18
1744.50	-1521.5	404.8	2651.7	.67	2.21	2.31
1745.00	-1516.3	330.6	2743.2	-.17	2.47	2.48
1745.50	-1522.4	265.7	2834.6	-.20	2.16	2.17
1746.00	-1495.9	207.5	2926.0	.88	1.93	2.13
1746.50	-1444.0	154.3	3017.5	1.73	1.77	2.47
1747.00	-1394.7	82.8	3108.9	1.64	2.38	2.89
1747.50	-1358.4	11.8	3200.4	1.21	2.36	2.65
1748.00	-1309.0	-47.9	3291.8	1.64	1.99	2.58
1748.50	-1261.3	-94.8	3383.2	1.59	1.56	2.22
1749.00	-1188.9	-133.3	3474.7	2.41	1.28	2.73
1749.50	-1111.1	-198.8	3566.1	2.59	2.18	3.39
1750.00	- 1026.8	-273.2	3657.6	2.80	2.47	3.74

Single Theodolite Data - Shoreline Station

Time	Balloon Position			Wind Velocity		
	X	Y	Z	U	V	VT
1800.00	.0	.0	.0			
1800.50	80.6	-178.7	91.4	2.68	-5.95	6.53
1801.00	203.8	-318.7	182.8	4.10	-4.66	6.21
1801.50	246.0	-380.3	274.3	1.40	-2.05	2.48
1802.00	206.6	-421.9	365.7	-1.31	-1.38	1.90
1802.50	153.6	-461.9	457.2	-1.76	-1.33	2.21
1803.00	82.1	-490.6	548.6	-2.38	- .95	2.57
1803.50	- .0	-500.0	640.0	-2.73	- .31	2.75
1804.00	- 74.9	-495.2	731.5	-2.49	.16	2.50
1804.50	-178.2	-484.4	822.9	-3.44	.35	3.46
1805.00	-297.9	-464.1	914.4	-3.99	.67	4.04
1805.50	-435.0	-453.6	1005.8	-4.56	.35	4.58
1806.00	-582.3	-424.6	1097.2	-4.91	.96	5.00
1806.50	-737.1	-396.1	1188.7	-5.15	.95	5.24
1807.00	-891.8	-367.5	1280.1	-5.15	.95	5.24
1807.50	-1049.1	-326.7	1371.6	-5.24	1.36	5.41
1808.00	-1212.7	-282.1	1463.0	-5.45	1.48	5.65
1808.50	-1379.6	-235.8	1554.4	-5.56	1.54	5.77
1809.00	-1509.9	-164.0	1645.9	-4.34	2.39	4.95
1809.50	-1557.5	- 62.5	1737.3	-1.58	3.38	3.73
1810.00	-1544.6	48.5	1828.8	.42	3.70	3.72
1810.50	-1513.3	161.7	1920.2	1.04	3.77	3.91
1811.00	-1474.3	273.2	2011.6	1.29	3.71	3.93
1811.50	-1466.4	387.4	2103.1	.26	3.80	3.81
1812.00	-1458.9	482.5	2194.5	.25	3.16	3.17
1812.50	-1463.4	538.4	2286.0	- .15	1.86	1.87
1813.00	-1495.0	579.9	2377.4	-1.05	1.38	1.73
1813.50	-1520.0	565.3	2468.8	- .83	-.48	.96
1814.00	-1524.4	524.9	2560.3	- .14	-1.34	1.35
1814.50	-1507.5	475.3	2651.7	.56	-1.65	1.74
1815.00	-1508.5	415.5	2743.2	- .03	-1.99	1.99
1815.50	-1520.9	367.9	2834.6	- .41	-1.58	1.63
1816.00	-1509.0	320.7	2926.0	.39	-1.57	1.62
1816.50	-1477.8	281.9	3017.6	1.04	-1.29	1.66
1817.00	-1432.6	221.8	3108.9	1.50	-2.00	2.50
1817.50	-1402.1	162.2	3200.4	1.01	-1.98	2.22
1818.00	-1358.3	118.8	3291.8	1.46	-1.44	2.05
1818.50	-1316.7	78.2	3383.2	1.38	-1.35	1.93
1819.00	-1263.6	50.7	3474.7	1.76	- .91	1.99
1819.50	-1193.5	4.6	3566.1	2.33	-1.53	2.79
1820.00	-1110.3	- 44.5	3657.6	2.77	-1.64	3.22

Single Theodolite Data - Shoreline Station

Time	Balloon Position			Wind Velocity		
	X	Y	Z	U	V	VT
2015.00	.0	1000.0	.0			
2015.50	- 73.4	181.8	91.4	-2.44	-27.27	27.38
2016.00	- 194.9	166.5	182.8	-4.05	- .51	4.08
2016.50	- 385.8	159.8	274.3	-6.36	- .22	6.36
2017.00	- 532.8	129.8	365.7	-4.90	- .99	5.00
2017.50	- 711.1	131.8	457.2	-5.94	.06	5.94
2018.00	- 883.7	143.1	548.6	-5.75	.37	5.76
2018.50	- 1050.9	173.9	640.0	-5.57	1.02	5.66
2019.00	- 1237.3	220.4	731.5	-6.21	1.54	6.40
2019.50	- 1451.8	279.6	822.9	-7.14	1.97	7.41
2020.00	- 1637.2	330.1	914.4	-6.17	1.68	6.40
2020.50	- 1844.6	382.0	1005.8	-6.91	1.72	7.12
2021.00	- 2072.8	429.2	1097.2	-7.60	1.57	7.76
2021.50	- 2236.0	463.0	1188.7	-5.43	1.12	5.55
2022.00	- 2364.9	502.7	1280.1	-4.29	1.32	4.49
2022.50	- 2480.0	581.7	1371.6	-3.83	2.63	4.65
2023.00	- 2475.7	662.4	1463.0	.14	2.69	2.69
2023.50	- 2465.5	749.1	1554.4	.33	2.88	2.90

Single Theodolite Data - Shoreline Station

Time	Balloon Position			Wind Velocity		
	X	Y	Z	U	V	VT
2030.00	.0	1000.0	.0			
2030.50	- 98.8	174.6	91.4	-3.29	-27.51	27.70
2031.00	- 248.8	164.7	182.8	-5.00	- .33	5.01
2031.50	- 424.2	142.7	274.3	-5.84	- .73	5.89
2032.00	- 595.3	148.4	365.7	-5.70	.18	5.70
2032.50	- 761.0	167.3	457.2	-5.52	.63	5.56
2033.00	- 913.6	199.2	548.6	-5.08	1.06	5.19
2033.50	-1116.8	253.7	640.0	-6.77	1.81	7.01
2034.00	-1321.0	317.1	731.5	-6.80	2.11	7.12
2034.50	-1519.0	359.0	822.9	-6.59	1.39	6.74
2035.00	-1717.4	402.8	914.4	-6.61	1.45	6.77
2035.50	-1941.7	441.1	1005.8	-7.47	1.27	7.58
2036.00	-2170.0	469.2	1097.2	-7.60	.93	7.66
2036.50	-2308.3	507.5	1188.7	-4.61	1.27	4.78
2037.00	-2382.0	567.5	1280.1	-2.45	1.99	3.16
2037.50	-2398.8	647.2	1371.6	- .56	2.65	2.71
2038.00	-2423.8	773.5	1463.0	- .83	4.20	4.29
2038.50	-2429.5	947.2	1554.4	- .18	5.78	5.79
2039.00	-2413.2	1130.5	1645.9	.54	6.10	6.13
2039.50	-2357.8	1307.0	1737.3	1.84	5.88	6.16
2040.00	-2287.0	1418.0	1828.8	2.35	3.70	4.39
2040.50	-2210.1	1502.0	1920.2	2.56	2.80	3.79
2041.00	-2178.2	1576.8	2011.6	1.06	2.49	2.70
2041.50	-2118.3	1661.0	2103.1	1.99	2.80	3.44
2042.00	-2083.6	1717.6	2194.5	1.15	1.88	2.21
2042.50	-2114.0	1748.9	2286.0	-1.01	1.04	1.45
2043.00	-2169.3	1775.6	2377.4	-1.84	.88	2.04
2043.50	-2238.5	1812.7	2468.8	-2.30	1.23	2.61
2044.00	-2279.2	1832.6	2560.3	-1.35	.66	1.50
2044.50	-2329.4	1768.1	2651.7	-1.67	- 2.14	2.72
2045.00	-2342.1	1745.8	2743.2	- .42	- .74	.85
2045.50	-2329.8	1717.7	2834.6	.40	- .93	1.02

Double Theodolite Data - 8 KM Station

Time	Balloon Position			Wind Velocity		
	X	Y	Z	U	V	W
1100.00	8046.7	304.8	.0			
1100.50	7960.4	343.4	110.2	-2.87	1.28	.62
1101.00	7892.2	380.4	203.8	-2.27	1.23	.07
1101.50	7834.4	408.0	287.6	-1.92	.92	-.25
1102.00	7778.9	418.7	368.3	-1.84	.35	-.35
1102.50	7715.3	418.6	464.7	-2.12	-.00	.16
1103.00	7628.3	409.9	591.6	-2.89	-.28	1.18
1103.50	7532.0	376.0	723.2	-3.21	-1.13	1.34
1104.00	7452.5	304.2	845.1	-2.64	-2.39	1.01
1104.50	7387.8	214.3	971.9	-2.15	-2.99	1.17
1105.00	7342.1	139.4	1094.4	-1.52	-2.49	1.03
1105.50	7327.8	89.0	1187.1	-.47	-1.67	.04
1106.00	7324.7	50.4	1243.0	-.10	-1.28	-1.18
1106.50	7307.1	8.0	1289.9	-.58	-1.41	-1.48
1107.00	7256.2	-39.3	1366.3	-1.39	-1.57	-.50
1107.50	7196.7	-81.9	1486.9	-2.28	-1.42	.97
1108.00	7121.7	-106.7	1623.0	-2.50	-.82	1.48
1108.50	7070.3	-109.0	1709.6	-1.71	-.07	-.16
1109.00	7038.9	-114.9	1737.7	-1.04	-.19	-2.11
1109.50	6990.3	-149.2	1766.7	-1.61	-1.14	-2.08
1110.00	6903.8	-202.6	1826.2	-2.88	-1.77	-1.06
1110.50	6803.8	-259.9	1891.4	-3.33	-1.90	-.87
1111.00	6706.2	-325.9	1953.1	-3.25	-2.20	-.99
1111.50	6609.8	-409.0	2016.9	-3.21	-2.76	-.91
1112.00	6450.6	-551.1	2183.8	-5.30	-4.73	2.51
1112.50	6236.7	-745.4	2436.4	-7.12	-6.47	5.37
1113.00	6112.9	-896.2	2547.0	-4.12	-5.02	.63
1113.50	6109.0	-987.8	2504.3	-.12	-3.05	-4.47
1114.00	6173.9	-1064.4	2424.8	2.16	-2.55	-5.69
1114.50	6238.1	-1163.2	2381.6	2.14	-3.29	-4.48
1115.00	6265.7	-1290.1	2404.8	.91	-4.23	-2.27
1115.50	6302.5	-1396.4	2428.7	1.22	-3.54	-2.25
1116.00	6308.3	-1515.8	2483.7	.19	-3.97	-1.21
1116.50	6260.7	-1690.3	2599.2	-1.58	-5.81	.80
1117.00	6274.9	-1819.1	2632.0	.47	-4.29	-1.95
1117.50	6321.0	-1926.8	2628.4	1.53	-3.58	-3.33
1118.00	6334.7	-2073.5	2663.7	.45	-4.89	-1.70
1118.50	6392.6	-2160.3	2642.2	1.93	-2.89	-3.76
1119.00	6469.3	-2244.3	2615.7	2.55	-2.80	-3.93
1119.50	6506.4	-2434.3	2699.8	1.23	-6.33	-.24
1120.00	6531.1	-2674.6	2840.9	.82	-8.01	1.65

Double Theodolite Data - 8 KM Station

Time	Balloon Position			Wind Velocity		
	X	Y	Z	U	V	W
1130.00	8046.7	304.8	.0			
1130.50	7991.8	319.4	182.9	-1.83	.48	3.05
1131.00	7942.4	328.9	368.5	-1.64	.31	3.13
1131.50	7903.9	328.3	559.3	-1.28	-.02	3.31
1132.00	7870.8	322.5	752.8	-1.10	-.19	3.40
1132.50	7838.2	314.1	947.3	-1.08	-.28	3.43
1133.00	7807.9	303.7	1142.5	-1.01	-.34	3.45
1133.50	7778.3	287.3	1311.1	-.98	-.54	2.56
1134.00	7749.1	258.7	1433.6	-.97	-.95	1.03
1134.50	7726.4	235.2	1536.1	-.75	-.78	.36
1135.00	7707.2	233.0	1642.4	-.64	-.07	.49
1135.50	7671.0	243.1	1755.5	-1.20	.33	.72
1136.00	7603.2	244.9	1857.7	-2.26	.05	.35
1136.50	7517.2	229.3	1934.0	-2.86	-.51	-.50
1137.00	7422.0	201.0	2003.1	-3.17	-.94	-.74
1137.50	7308.5	161.3	2071.1	-3.78	-1.32	-.78
1138.00	7165.7	100.7	2158.0	-4.76	-2.01	-.15
1138.50	7034.8	22.3	2235.2	-4.36	-2.61	-.47
1139.00	6934.8	-70.3	2292.2	-3.33	-3.08	-1.14
1139.50	6812.5	-179.9	2400.4	-4.07	-3.65	.55
1140.00	6675.3	-296.0	2523.5	-4.57	-3.87	1.05
1140.50	6566.8	-415.1	2606.9	-3.61	-3.97	-.26
1141.00	6536.8	-525.8	2602.5	-1.00	-3.68	-3.19
1141.50	6555.6	-637.1	2555.0	.62	-3.70	-4.63
1142.00	6547.0	-773.8	2580.1	-.28	-4.55	-2.21
1142.50	6512.1	-925.5	2670.7	-1.16	-5.05	-.02
1143.00	6496.2	-1043.2	2725.2	-.53	-3.92	-1.23
1143.50	6527.1	-1121.8	2698.1	1.03	-2.62	-3.95
1144.00	6533.1	-1245.8	2722.3	.20	-4.13	-2.23
1144.50	6449.1	-1475.7	2897.8	-2.79	-7.66	2.80
1145.00	6355.1	-1737.5	3086.0	-3.13	-8.72	3.22
1145.50	6349.4	-1925.1	3138.6	-.18	-6.25	-1.29
1146.00	6373.6	-2111.7	3188.8	.80	-6.21	-1.37
1146.50	6390.6	-2333.4	3303.0	.56	-7.39	.75
1147.00	6478.4	-2459.7	3312.3	2.92	-4.20	-2.73
1147.50	6608.1	-2541.3	3262.9	4.32	-2.71	-4.69
1148.00	6691.3	-2739.8	3335.2	2.77	-6.61	-.63
1148.50	6777.3	-2933.2	3403.0	2.86	-6.44	-.78
1149.00	6903.6	-3046.1	3389.3	4.21	-3.76	-3.50
1149.50	7007.3	-3232.5	3453.6	3.45	-6.21	-.90
1150.00	7093.0	-3462.7	3563.9	2.85	-7.67	.62

Double Theodolite Data - 8 KM Station

Time	Balloon Position			Wind Velocity		
	X	Y	Z	U	V	W
1200.00	8046.7	304.8	.0			
1200.50	7983.7	277.5	197.3	-2.09	-.90	3.53
1201.00	7920.8	250.2	394.7	-2.09	-.90	3.53
1201.50	7857.8	222.9	592.1	-2.09	-.90	3.53
1202.00	7794.9	195.6	789.4	-2.09	-.90	3.53
1202.50	7731.9	168.3	986.8	-2.09	-.90	3.53
1203.00	7669.0	141.0	1184.2	-2.09	-.90	3.53
1203.50	7611.1	136.0	1364.8	-1.93	-.16	2.97
1204.00	7560.3	160.9	1497.5	-1.69	.83	1.37
1204.50	7519.7	176.0	1575.6	-1.35	.50	-.44
1205.00	7488.2	177.0	1648.8	-1.05	.03	-.60
1205.50	7451.3	196.8	1745.3	-1.22	.65	.16
1206.00	7396.4	232.0	1835.7	-1.82	1.17	-.03
1206.50	7321.1	258.5	1902.5	-2.50	.88	-.82
1207.00	7233.3	275.8	1954.4	-2.92	.57	-1.31
1207.50	7121.8	282.7	2035.4	-3.71	.22	-1.34
1208.00	6997.0	262.2	2117.4	-4.15	-.68	-.31
1208.50	6873.4	208.2	2182.2	-4.12	-1.79	-.88
1209.00	6734.4	131.9	2285.9	-4.63	-2.54	.40
1209.50	6608.9	48.8	2382.5	-4.18	-2.77	.17
1210.00	6518.2	-40.1	2441.3	-3.02	-2.96	-1.09
1210.50	6439.2	-134.2	2494.6	-2.63	-3.13	-1.26
1211.00	6379.0	-232.7	2537.5	-2.00	-3.28	-1.61
1211.50	6330.7	-354.5	2611.2	-1.61	-4.05	-.59
1212.00	6184.6	-534.0	2877.3	-4.87	-5.98	5.82
1212.50	6037.0	-719.3	3165.3	-4.91	-6.17	6.55
1213.00	6091.1	-837.7	3165.1	1.80	-3.94	-3.05
1213.50	6224.7	-930.8	3029.7	4.45	-3.10	-7.56
1214.00	6248.1	-1087.4	3020.2	.78	-5.22	-3.36
1214.50	6156.4	-1341.9	3199.7	-3.05	-8.48	2.93
1215.00	6086.3	-1604.5	3397.8	-2.33	-8.75	3.55
1215.50	6089.0	-1832.3	3536.0	.09	-7.59	1.55
1216.00	6151.5	-2016.2	3617.5	2.08	-6.13	-.32
1216.50	6308.4	-2102.9	3542.2	5.22	-2.88	-5.55
1217.00	6424.6	-2274.4	3560.5	3.87	-5.71	-2.43
1217.50	6527.7	-2433.1	3587.1	3.43	-5.29	-2.16
1218.00	6736.7	-2401.4	3385.8	6.96	1.05	-9.75
1218.50	6877.0	-2514.6	3372.1	4.67	-3.77	-3.50
1219.00	6862.3	-3120.2	3931.8	-.48	-20.18	15.60
1219.50	6820.0	-4069.0	4847.9	-1.41	-31.62	27.48
1220.00	6929.4	-4711.9	5387.8	3.64	-21.42	14.94

Double Theodolite Data - 8 KM Station

Time	Balloon Position			Wind Velocity		
	X	Y	Z	U	V	W
1330.00	8046.7	304.8	.0			
1330.50	7982.1	349.0	81.0	-2.15	1.47	-.34
1331.00	7909.8	393.1	161.0	-2.41	1.46	-.37
1331.50	7825.8	432.0	237.7	-2.79	1.29	-.49
1332.00	7738.6	466.9	313.1	-2.90	1.16	-.53
1332.50	7650.3	509.9	398.3	-2.94	1.43	-.20
1333.00	7569.8	553.8	504.0	-2.68	1.46	.47
1333.50	7506.3	584.3	629.0	-2.11	1.01	1.11
1334.00	7446.3	602.2	766.2	-2.00	.59	1.52
1334.50	7379.2	598.3	929.3	-2.23	-.13	2.30
1335.00	7325.2	566.8	1123.0	-1.79	-1.04	3.40
1335.50	7298.4	517.2	1302.2	-.89	-1.65	2.92
1336.00	7272.8	461.4	1427.0	-.85	-1.85	1.11
1336.50	7239.0	408.8	1507.0	-1.12	-1.75	-.38
1337.00	7209.4	355.1	1560.8	-.98	-1.78	-1.25
1337.50	7161.6	298.3	1615.2	-1.59	-1.89	-1.23
1338.00	7087.6	263.2	1689.9	-2.46	-1.16	-.55
1338.50	7021.0	268.4	1759.4	-2.21	.17	-.73
1339.00	6966.9	292.5	1815.2	-1.80	.80	-1.18
1339.50	6894.8	321.2	1882.3	-2.40	.95	-.81
1340.00	6794.2	356.7	1961.4	-3.35	1.18	-.40
1340.50	6682.2	386.2	2038.9	-3.73	.98	-.46
1341.00	6565.2	400.4	2114.9	-3.89	.47	-.51
1341.50	6437.4	406.1	2212.2	-4.26	.18	.19
1342.00	6317.8	416.6	2334.2	-3.98	.34	1.01
1342.50	6177.1	432.2	2519.4	-4.68	.52	3.12
1343.00	5990.3	416.2	2769.8	-6.22	-.53	5.29
1343.50	5850.9	345.2	2960.7	-4.64	-2.36	3.31
1344.00	5810.0	247.6	3070.9	-1.36	-3.25	.62
1344.50	5847.7	145.0	3133.5	1.25	-3.42	-0.96
1345.00	6193.3	81.9	2737.7	11.52	-2.10	-16.23
1345.50	6475.8	-23.7	2404.4	9.41	-3.52	-14.15
1346.00	6146.9	-275.3	2972.4	-10.96	-8.38	15.88
1346.50	5926.6	-497.9	3364.3	-7.34	-7.41	10.01
1347.00	6008.7	-682.4	3315.8	2.73	-6.15	-4.66
1347.50	5926.1	-958.5	3566.9	-2.75	-9.20	5.32
1348.00	5860.2	-1225.3	3829.9	-2.19	-8.89	5.72
1348.50	5918.6	-1432.0	3917.7	1.94	-6.88	-.12
1349.00	6027.7	-1601.2	3928.9	3.63	-5.64	-2.67
1349.50	6176.8	-1719.6	3880.5	4.96	-3.94	-4.66
1350.00	6336.5	-1818.2	3839.7	5.32	-3.28	-4.40

Double Theodolite Data - 8 KM Station

Time	Balloon Position			Wind Velocity		
	X	Y	Z	U	V	W
1400.00	8046.7	.0	.0			
1400.50	7964.5	285.5	123.4	-2.73	9.51	1.06
1401.00	7892.5	420.5	233.9	-2.39	4.49	.63
1401.50	7833.3	486.2	339.1	-1.97	2.18	.45
1402.00	7791.0	558.9	440.4	-1.41	2.42	.32
1402.50	7759.1	623.3	534.8	-1.06	2.14	.09
1403.00	7728.8	671.1	636.6	-1.01	1.59	.34
1403.50	7701.7	712.0	747.6	-.90	1.36	.65
1404.00	7677.9	749.4	861.7	-.79	1.24	.75
1404.50	7650.3	780.8	989.9	-.92	1.04	1.22
1405.00	7613.9	810.0	1142.1	-1.21	.97	2.02
1405.50	7544.3	861.0	1353.4	-2.32	1.69	3.99
1406.00	7442.7	915.0	1556.9	-3.38	1.80	3.73
1406.50	7356.8	910.9	1641.7	-2.86	-.13	-.22
1407.00	7289.1	867.1	1686.8	-2.25	-1.46	-1.54
1407.50	7210.0	832.7	1783.0	-2.63	-1.14	.15
1408.00	7107.8	830.0	1909.4	-3.40	-.08	1.16
1408.50	6994.4	858.8	2016.9	-3.77	.95	.53
1409.00	6882.4	896.8	2101.4	-3.73	1.26	-.23
1409.50	6770.4	934.7	2185.9	-3.73	1.26	-.23
1410.00	6658.5	972.7	2270.3	-3.73	1.26	-.23
1410.50	6546.5	1010.6	2354.8	-3.73	1.26	-.23
1411.00	6440.5	1055.5	2464.7	-3.53	1.49	.61
1411.50	6376.6	1101.1	2575.0	-2.12	1.51	.62
1412.00	6367.5	1126.5	2629.3	-.30	.84	-1.23
1412.50	6329.5	1133.2	2712.7	-1.26	.22	-.26
1413.00	6223.5	1110.1	2875.3	-3.53	-.76	2.37
1413.50	6131.9	1039.1	3019.2	-3.05	-2.36	1.74
1414.00	6126.5	929.7	3075.3	-.17	-3.64	-1.18
1414.50	6173.5	790.4	3086.4	1.56	-4.64	-2.67
1415.00	6203.9	622.2	3109.9	1.01	-5.60	-2.26
1415.50	6200.7	431.4	3154.0	-.10	-6.35	-1.57
1416.00	6174.3	233.3	2340.6	-.87	-6.60	-.16
1416.50	6186.5	36.1	3292.6	.40	-6.57	-1.31
1417.00	6228.3	-163.3	3323.1	1.39	-6.65	-2.02
1417.50	6245.6	-363.9	3430.2	.57	-6.68	.52
1418.00	6290.6	-552.9	3516.3	1.49	-6.29	-.17

Double Theodolite Data - 8 KM Station

Time	Balloon Position			Wind Velocity		
	X	Y	Z			
1430.00	8046.7	304.8	.0			
1430.50	7937.4	307.0	58.2	-3.64	.07	-1.10
1431.00	7828.1	309.3	116.5	-3.64	.07	-1.10
1431.50	7716.3	315.0	176.0	-3.72	.18	-1.06
1432.00	7600.2	332.3	242.4	-3.86	.57	-.83
1432.50	7482.8	364.0	317.5	-3.91	1.05	-.54
1433.00	7366.2	406.9	397.8	-3.88	1.43	-.37
1433.50	7254.2	457.6	478.1	-3.73	1.68	-.36
1434.00	7149.2	509.0	549.6	-3.49	1.71	-.66
1434.50	7047.2	558.6	614.6	-3.39	1.65	-.88
1435.00	6945.2	608.3	679.6	-3.39	1.65	-.88
1435.50	6856.3	655.8	739.8	-2.96	1.58	-1.03
1436.00	6787.4	705.0	795.2	-2.29	1.63	-1.20
1436.50	6717.1	765.4	857.3	-2.34	2.01	-.97
1437.00	6625.7	831.8	932.8	-3.04	2.21	-.53
1437.50	6517.8	891.3	1021.8	-3.59	1.98	-.08
1438.00	6409.2	948.0	1117.9	-3.61	1.89	.15
1438.50	6314.0	1001.1	1202.6	-3.17	1.77	-.22
1439.00	6236.4	1038.4	1279.2	-2.58	1.24	-.49
1439.50	6162.1	1066.7	1367.8	-2.47	.94	-.09
1440.00	6084.1	1096.8	1466.5	-2.60	1.00	.24
1440.50	6010.7	1133.1	1574.8	-2.44	1.20	.56
1441.00	5945.4	1172.2	1693.5	-2.17	1.30	.90
1441.50	5892.4	1210.0	1807.5	-1.76	1.26	.75
1442.00	5849.0	1269.7	1915.5	-1.44	1.99	.55
1442.50	5831.2	1354.9	1999.7	-.59	2.83	-.24
1443.00	5816.9	1453.5	2067.4	-.47	3.28	-.78
1443.50	5757.8	1571.3	2165.0	-1.97	3.92	.20
1444.00	5667.5	1700.8	2287.7	-3.00	4.31	1.04
1444.50	5569.3	1820.2	2403.0	-3.27	3.98	.79
1445.00	5493.2	1907.9	2469.7	-2.53	2.92	-.82
1445.50	5427.2	1976.7	2512.2	-2.20	2.29	-1.62
1446.00	5352.7	2034.2	2583.3	-2.48	1.91	-.67
1446.50	5264.1	2070.8	2697.5	-2.95	1.22	.75
1447.00	5134.5	2094.8	2860.7	-4.32	.80	2.39

Double Theodolite Data - 8 KM Station

Time	Balloon Position			Wind Velocity		
	X	Y	Z	U	V	W
1500.00	8046.7	304.8				
1500.50	7914.2	328.2	122.4	-4.41	.78	1.03
1501.00	7808.3	362.0	239.5	-3.52	1.12	.85
1501.50	7723.4	418.1	356.2	-2.83	1.86	.84
1502.00	7652.7	482.3	479.0	-2.35	2.14	1.04
1502.50	7594.4	522.8	602.1	-1.94	1.35	1.05
1503.00	7529.2	538.3	734.6	-2.17	.51	1.36
1503.50	7453.6	540.5	883.8	-2.51	.07	1.92
1504.00	7388.6	525.8	1027.3	-2.16	-.49	1.73
1504.50	7342.4	502.4	1150.2	-1.54	-.78	1.04
1505.00	7315.6	485.9	1247.9	-.89	-.54	.20
1505.50	7300.7	467.6	1332.4	-.49	-.60	-.23
1506.00	7274.9	435.2	1420.9	-.86	-1.08	-.09
1506.50	7227.7	429.8	1505.8	-1.57	-.18	-.21
1507.00	7173.4	486.3	1580.2	-1.81	1.88	-.56
1507.50	7121.1	571.0	1650.3	-1.74	2.82	-.70
1508.00	7068.9	655.7	1720.5	-1.74	2.82	-.70
1508.50	7016.6	740.5	1790.6	-1.74	2.82	-.70
1509.00	6964.4	825.2	1860.8	-1.74	2.82	-.70
1509.50	6912.1	909.9	1930.9	-1.74	2.82	-.70
1510.00	6859.9	994.6	2001.1	-1.74	2.82	-.70
1510.50	6807.6	1079.3	2071.2	-1.74	2.82	-.70
1511.00	6741.3	1155.1	2162.7	-2.21	2.52	.00
1511.50	6647.8	1192.9	2291.6	-3.11	1.25	1.24
1512.00	6568.1	1163.4	2403.9	-2.65	-.98	.69
1512.50	6549.2	1077.4	2466.3	-.63	-2.86	-.96
1513.00	6563.4	964.5	2527.5	.47	-3.76	-1.00
1513.50	6565.0	828.2	2606.8	.05	-4.54	-.40
1514.00	6549.9	671.4	2690.5	-.50	-5.22	-.25
1514.50	6539.2	503.4	2764.0	-.35	-5.59	-.59
1515.00	6546.4	324.9	2815.6	.24	-5.95	-1.32
1515.50	6558.4	147.9	2874.8	.40	-5.89	-1.07
1516.00	6575.8	-17.2	2942.9	.58	-5.50	-.78
1516.50	6611.5	-175.4	2997.9	1.19	-5.27	-1.21
1517.00	6641.4	-336.7	3089.7	.99	-5.37	.01
1517.50	6665.4	-503.5	3226.9	.80	-5.55	1.52
1518.00	6725.1	-664.8	3343.5	1.98	-5.37	.83
1518.50	6817.3	-822.8	3447.5	3.07	-5.26	.41
1519.00	6942.4	-961.5	3501.9	4.16	-4.62	-1.23
1519.50	7125.8	-1025.4	3374.8	6.11	-2.12	-7.28
1520.00	7346.2	-1010.2	3086.3	7.34	.50	-12.66

Double Theodolite Data - 8 KM Station

Time	Balloon Position			Wind Velocity		
	X	Y	Z	U	V	W
1530.00	8046.7					
1530.50	8088.4	199.5	124.6	1.38	6.65	1.10
1531.00	8092.1	273.1	247.7	.12	2.45	1.05
1531.50	8047.5	295.6	326.5	-1.48	.74	-.42
1532.00	7988.2	319.1	387.2	-1.97	.78	-1.02
1532.50	7928.8	340.4	476.2	-1.98	.71	-.08
1533.00	7848.6	380.5	595.3	-2.67	1.33	.92
1533.50	7741.0	433.6	724.6	-3.58	1.77	1.26
1534.00	7609.9	476.2	843.6	-4.36	1.41	.91
1534.50	7461.3	503.8	957.1	-4.95	.91	.73
1535.00	7311.7	524.0	1059.1	-4.98	.67	.35
1535.50	7171.5	540.9	1133.7	-4.67	.56	-.56
1536.00	7036.8	545.7	1183.6	-4.48	.16	-1.38
1536.50	6911.8	528.8	1215.1	-4.16	-.56	-1.99
1537.00	6808.8	494.4	1242.1	-3.43	-1.14	-2.14
1537.50	6706.4	440.7	1289.0	-3.41	-1.79	-1.48
1538.00	6563.3	388.4	1389.3	-4.76	-1.74	.29
1538.50	6430.2	388.3	1509.4	-4.43	-.00	.95
1539.00	6373.4	447.6	1577.3	-1.89	1.97	-.78
1539.50	6324.1	543.3	1630.2	-1.64	3.18	-1.28
1540.00	6255.1	657.3	1704.5	-2.29	3.80	-.57
1540.50	6217.0	770.3	1767.0	-1.27	3.76	-.96
1541.00	6217.6	863.3	1795.6	.02	3.10	-2.09
1541.50	6243.8	935.3	1795.1	.87	2.39	-3.06
1542.00	6248.4	1002.0	1808.3	.15	2.22	-2.60
1542.50	6220.3	1061.2	1844.8	-.93	1.97	-1.82
1543.00	6155.6	1116.4	1911.0	-2.15	1.84	-.84
1543.50	6039.2	1168.9	2023.3	-3.87	1.75	.69
1544.00	5977.8	1167.5	2086.3	-2.04	-.04	-.94
1544.50	5984.8	1113.0	2107.1	.23	-1.81	-2.35
1545.00	5919.9	1081.6	2236.4	-2.16	-1.04	1.26

Double Theodolite Data - 8 KM Station

Time	Balloon Position			Wind Velocity		
1600.00	8046.7	304.8	.0			
1600.50	8196.7	224.4	85.4	4.99	-2.67	-.19
1601.00	8319.8	157.1	178.1	4.10	-2.24	.04
1601.50	8390.7	108.2	275.0	2.36	-1.62	.18
1602.00	8409.8	62.7	373.8	.63	-1.51	.24
1602.50	8401.9	13.6	472.8	-.26	-1.63	.25
1603.00	8392.2	-32.7	561.7	-.32	-1.54	-.08
1603.50	8399.1	-64.3	643.5	.23	-1.05	-.32
1604.00	8414.0	-74.4	740.2	.49	-.33	.17
1604.50	8418.4	-77.9	859.7	.14	-.11	.93
1605.00	8405.0	-67.5	984.0	-.44	.34	1.09
1605.50	8341.3	-29.0	1101.6	-2.12	1.28	.87
1606.00	8219.9	12.8	1231.6	-4.04	1.39	1.28

Double Theodolite Data - 8 KM Station

Time	Balloon Position			Wind Velocity		
1630.00	8046.7	304.8	.0			
1630.50	8142.1	242.9	130.8	3.18	-2.06	1.31
1631.00	8191.1	187.4	242.5	1.63	-1.84	.67
1631.50	8217.0	135.1	344.6	.86	-1.74	.35
1632.00	8223.4	87.8	440.4	.21	-1.57	.14
1632.50	8172.5	55.1	529.9	-1.69	-1.09	-.06
1633.00	8065.2	36.7	625.5	-3.57	-.61	.13
1633.50	7939.5	23.1	727.3	-4.19	-.45	.34
1634.00	7813.8	9.5	829.2	-4.19	-.45	.34
1634.50	7688.1	-4.1	931.1	-4.19	-.45	.34
1635.00	7562.4	-17.7	1032.9	-4.19	-.45	.34
1635.50	7443.8	-29.5	1115.6	-3.95	-.39	-.29
1636.00	7332.1	-37.6	1172.6	-3.72	-.27	-1.14
1636.50	7211.4	-42.2	1239.1	-4.02	-.15	-.82
1637.00	7080.6	-38.9	1323.3	-4.35	.10	-.24
1637.50	6956.1	-19.7	1402.2	-4.14	.64	-.41
1638.00	6857.6	25.5	1467.5	-3.28	1.50	-.87
1638.50	6785.5	101.8	1545.0	-2.40	2.54	-.46
1639.00	6717.4	198.1	1662.3	-2.27	3.21	.86
1639.50	6669.9	301.9	1767.7	-1.58	3.45	.46
1640.00	6647.9	410.6	1838.9	-.73	3.62	-.67
1640.50	6612.4	523.1	1929.8	-1.18	3.75	-.01
1641.00	6596.5	625.7	2009.9	-.53	3.41	-.37
1641.50	6609.4	703.7	2062.9	.43	2.59	-1.28
1642.00	6597.5	758.6	2131.6	-.39	1.83	-.75
1642.50	6577.1	779.4	2185.2	-.68	.69	-1.26
1643.00	6561.0	756.6	2221.5	-.53	-.75	-1.83
1643.50	6537.4	706.8	2290.2	-.78	-1.66	-.75
1644.00	6521.5	636.0	2382.9	-.53	-2.36	.04
1644.50	6517.3	541.2	2454.7	-.13	-3.15	-.65
1645.00	6519.3	432.8	2486.8	.06	-3.61	-1.98

Double Theodolite Data - 8 KM Station

Time	Balloon Position			Wind Velocity		
	X	Y	Z	U	V	W
1700.00	8046.7	304.8	.0			
1700.50	8174.5	222.5	92.6	4.26	-2.74	.04
1701.00	8267.7	145.5	189.5	3.10	-2.56	.18
1701.50	8296.0	78.9	292.3	.94	-2.22	.37
1702.00	8275.0	27.3	399.7	-.69	-1.71	.53
1702.50	8235.0	-7.5	507.8	-1.33	-1.16	.55
1703.00	8178.4	-34.0	611.1	-1.88	-.88	.39
1703.50	8098.8	-51.0	693.7	-2.65	-.56	-.29
1704.00	7997.6	-53.3	758.6	-3.37	-.07	-.88
1704.50	7881.3	-52.3	828.8	-3.87	.03	-.70
1705.00	7758.9	-55.6	901.5	-4.08	-.11	-.62
1705.50	7632.9	-58.7	971.7	-4.19	--.10	-.70
1706.00	7503.4	-56.7	1053.5	-4.31	.06	-.32
1706.50	7379.2	-47.3	1152.1	-4.13	.31	.23
1707.00	7256.9	-25.9	1250.5	-4.07	.71	.23
1707.50	7120.7	6.4	1341.9	-4.54	1.07	-.00
1708.00	6991.6	44.1	1424.6	-4.30	1.25	-.29
1708.50	6888.5	89.4	1502.3	-3.43	1.51	-.46
1709.00	6792.9	156.9	1606.8	-3.18	2.24	.43
1709.50	6728.6	257.5	1724.7	-2.14	3.35	.87
1710.00	6715.2	376.7	1814.8	-.44	3.97	-.04
1710.50	6709.0	493.6	1893.5	-.20	3.89	-.42
1711.00	6700.5	595.0	1972.6	-.28	3.37	-.40
1711.50	6706.7	668.6	2037.9	.20	2.45	-.87
1712.00	6704.1	707.2	2101.0	-.08	1.28	-.94
1712.50	6679.6	706.0	2173.6	-.81	-.03	-.62
1713.00	6663.8	666.0	2241.2	-.52	-1.33	-.79
1713.50	6660.7	601.4	2327.1	-.10	-2.15	-.18
1714.00	6659.4	523.8	2416.8	-.04	-2.58	-.05
1714.50	6656.4	436.2	2488.0	-.09	-2.91	-.67
1715.00	6624.2	346.3	2614.5	-1.07	-2.99	1.16

Double Theodolite Data - 8 KM Station

Time	Balloon Position			Wind Velocity		
	X	Y	Z	U	V	W
1800.00	8046.7	304.8				
1800.50	8116.4	215.1	107.2	2.32	-2.98	.52
1801.00	8157.8	124.1	206.1	1.38	-3.03	.24
1801.50	8171.4	38.6	301.6	.45	-2.85	.13
1802.00	8152.3	-30.8	398.1	-.63	-2.31	.16
1802.50	8099.3	-83.2	497.1	-1.76	-1.74	.25
1803.00	8022.8	-113.8	594.8	-2.55	-1.02	.20
1803.50	7937.3	-121.1	687.5	-2.84	-.24	.04
1804.00	7853.3	-119.2	773.1	-2.79	.06	-.19
1804.50	7773.2	-117.2	846.5	-2.66	.06	-.60
1805.00	7678.8	-120.6	924.9	-3.14	-.11	-.43
1805.50	7559.2	-117.0	1008.7	-3.98	.12	-.25
1806.00	7433.2	-86.4	1084.4	-4.20	1.02	-.52
1806.50	7308.5	-41.5	1164.9	-4.15	1.49	-.36
1807.00	7189.3	-.9	1250.7	-3.97	1.35	-.18
1807.50	7076.6	35.8	1330.9	-3.75	1.22	-.37
1808.00	6962.1	76.7	1408.3	-3.81	1.36	-.46
1808.50	6848.8	129.8	1493.4	-3.77	1.77	-.20
1809.00	6745.8	206.6	1603.5	-3.43	2.56	.62
1809.50	6687.2	303.7	1726.1	-1.95	3.23	1.03
1810.00	6701.0	406.5	1811.3	.45	3.42	-.20
1810.50	6738.6	509.0	1866.7	1.25	3.41	-1.20
1811.00	6750.8	597.6	1940.8	.40	2.95	-.57
1811.50	6743.6	653.3	2027.3	-.23	1.85	-.16
1812.00	6721.3	675.3	2107.2	-.74	.73	-.38
1812.50	6711.2	665.4	2144.5	-.33	-.33	-1.80
1813.00	6722.0	629.6	2152.0	.35	-1.19	-2.79
1813.50	6730.7	586.1	2201.5	.29	-1.44	-1.39
1814.00	6741.3	543.8	2290.7	.35	-1.41	-.07
1814.50	6756.0	503.9	2372.7	.49	-1.32	-.31
1815.00	6800.0	459.5	2384.1	1.46	-1.48	-2.66

Double Theodolite Data - 8 KM Station

Time	Balloon Position			Wind Velocity		
	X	Y	Z	U	V	W
1830.00	8046.7	304.8	.0			
1830.50	8127.9	228.1	88.1	2.70	-2.55	-.10
1831.00	8190.8	153.1	167.9	2.09	-2.49	-.38
1831.50	8204.3	88.4	242.0	.44	-2.15	-.57
1832.00	8173.6	36.3	314.5	-1.02	-1.73	-.62
1832.50	8121.9	-9.7	387.3	-1.72	-1.53	-.62
1833.00	8054.0	-43.2	459.5	-2.26	-1.11	-.64
1833.50	7977.2	-55.7	529.6	-2.55	-.41	-.71
1834.00	7898.4	-58.7	601.2	-2.62	-.10	-.66
1834.50	7817.1	-64.2	674.7	-2.70	-.18	-.59
1835.00	7732.6	-75.1	745.3	-2.81	-.36	-.69
1835.50	7642.3	-87.0	812.2	-3.01	-.39	-.81
1836.00	7547.6	-89.1	879.3	-3.15	-.07	-.81
1836.50	7449.4	-77.3	949.7	-3.27	.39	-.69
1837.00	7344.1	-53.8	1021.5	-3.51	.78	-.65
1837.50	7234.4	-24.0	1086.6	-3.65	.99	-.88
1838.0	7124.9	10.6	1139.8	-3.65	1.15	-1.27
1838.50	7015.0	49.0	1186.0	-3.66	1.27	-1.50
1839.00	6903.7	82.2	1231.7	-3.71	1.10	-1.52
1839.50	6780.7	108.4	1289.6	-4.09	.87	-1.11
1840.00	6649.4	137.7	1353.5	-4.37	.97	-.91
1840.50	6527.0	175.1	1411.9	-4.07	1.24	-1.10
1841.00	6406.5	218.5	1484.3	-4.01	1.44	-.63

Double Theodolite Data - 8 KM Station

Time	Balloon Position			Wind Velocity		
	X	Y	Z	U	V	W
1900.00	8046.7	304.8	.0			
1900.50	8081.4	266.4	95.8	1.15	-1.27	.14
1901.00	8047.3	255.3	183.4	-1.13	-.37	-.12
1901.50	7978.7	257.7	266.8	-2.28	.08	-.26
1902.00	7910.2	260.1	350.2	-2.28	.08	-.26
1902.50	7841.6	262.5	433.6	-2.28	.08	-.26
1903.00	7773.0	264.9	517.0	-2.28	.08	-.26
1903.50	7704.5	267.3	600.4	-2.28	.08	-.26
1904.00	7635.9	269.7	683.7	-2.28	.08	-.26
1904.50	7567.4	272.1	767.1	-2.28	.08	-.26
1905.00	7498.8	274.5	850.5	-2.28	.08	-.26
1905.50	7430.3	276.9	933.9	-2.28	.08	-.26
1906.00	7345.9	286.8	1015.0	-2.81	.32	-.34
1906.50	7234.7	310.7	1087.5	-3.70	.79	-.63
1907.00	7118.4	341.1	1150.9	-3.87	1.01	-.93
1907.50	7026.3	367.4	1191.7	-3.07	.87	-1.68
1908.00	6933.9	389.5	1237.9	-3.07	.73	-1.50
1908.50	6806.6	425.4	1349.3	-4.24	1.19	.66
1909.00	6718.3	494.3	1480.9	-2.94	2.29	1.33
1909.50	6720.4	590.2	1579.5	.06	3.19	.23
1910.00	6792.1	684.9	1634.7	2.39	3.15	-1.20
1910.50	6905.6	760.5	1650.3	3.78	2.51	-2.53
1911.00	6994.6	831.3	1685.7	2.96	2.36	-1.86
1911.50	7039.2	912.4	1761.7	1.48	2.70	-.51
1912.00	7072.0	981.1	1827.2	1.09	2.29	-.86
1912.50	7080.0	1024.9	1897.3	.26	1.45	-.71
1913.00	7057.2	1048.3	1980.1	-.75	.78	-.28
1913.50	7043.2	1036.1	2016.7	-.46	-.40	-1.82
1914.00	7037.6	994.1	2039.6	-.18	-1.40	-2.28
1914.50	7023.1	994.5	2107.9	-.48	-1.65	-.77
1915.00	6992.2	904.3	2235.9	-1.02	-1.34	1.21

Single Theodolite Data - 8 KM Station

	Balloon Position			Wind Velocity		
Time	X	Y	Z	U	V	VT
0630.00	.0	.0	.0			
0630.50	- 78.5	-24.7	91.4	-2.61	- .82	2.74
0631.00	- 309.6	-60.1	182.8	-7.70	- 1.18	7.79
0631.50	- 511.8	-115.3	274.3	-6.73	- 1.83	6.98
0632.00	- 647.6	-223.0	365.7	-4.52	- 3.58	5.77
0632.50	- 719.6	-360.3	457.2	-2.39	- 4.57	5.16
0633.00	- 769.6	-484.6	548.6	-1.66	- 4.14	4.46
0633.50	- 822.3	-610.7	640.0	-1.75	- 4.20	4.55
0634.00	- 853.0	-715.8	731.5	-1.02	- 3.50	3.64
0634.50	- 877.1	-815.0	822.9	- .80	- 3.30	3.40
0635.00	- 887.2	-918.7	914.4	- .33	- 3.45	3.47
0635.50	- 877.7	-1031.3	1005.8	.31	- 3.75	3.76
0636.00	- 875.1	-1157.1	1097.2	.08	- 4.19	4.19
0636.50	- 890.2	-1295.3	1188.7	- .50	- 4.60	4.63
0637.00	- 918.5	-1458.6	1280.1	- .94	- 5.44	5.52
0637.50	- 934.6	-1672.3	1371.6	- .53	- 7.12	7.14
0638.00	- 939.6	-1901.2	1463.0	- .16	- 7.62	7.63
0638.50	- 925.7	-2139.1	1554.4	.46	- 7.92	7.94
0639.00	- 905.4	-2346.5	1645.9	.67	- 6.91	6.94
0639.50	- 911.5	-2504.3	1737.3	- .20	- 5.25	5.26
0640.00	- 929.6	-2669.6	1828.8	- .60	- 5.50	5.54
0640.50	- 967.6	-2842.3	1920.2	-1.26	- 5.75	5.89
0641.00	-1013.7	-2977.7	2011.6	-1.53	- 4.51	4.76
0641.50	-1001.4	-3119.1	2103.1	.40	- 4.71	4.72
0642.00	- 980.4	-3247.4	2194.5	.69	- 4.27	4.33
0642.50	- 952.5	-3388.7	2286.0	.93	- 4.71	4.80
0643.00	- 926.3	-3556.2	2377.4	.87	- 5.58	5.65
0643.50	- 858.5	-3718.4	2468.8	2.26	- 5.40	5.86
0644.00	- 755.1	-3884.9	2560.3	3.44	- 5.54	6.53
0644.50	- 655.8	-4094.2	2651.7	3.31	- 6.97	7.72
0645.00	- 576.9	-4267.1	2743.2	2.62	- 5.76	6.33
0645.50	- 464.5	-4494.9	2834.6	3.74	- 7.59	8.46
0646.00	- 340.0	-4744.0	2926.0	4.14	- 8.30	9.28
0646.50	- 139.1	-4980.5	3017.5	6.69	- 7.88	10.34
0647.00	90.9	-5214.5	3108.9	7.67	- 7.79	10.93
0647.50	303.2	-5424.7	3200.4	7.07	- 7.00	9.95
0648.00	481.1	-5612.7	3291.8	5.92	- 6.26	8.62
0648.50	727.1	-5838.5	3383.2	8.20	- 7.52	11.13
0649.00	979.2	-6113.9	3474.7	8.40	- 9.17	12.44
0649.50	1204.0	-6411.4	3566.1	7.49	- 9.91	12.43
0650.00	1418.4	-6731.0	3657.6	7.14	-10.65	12.82

Single Theodolite Data - 8 KM Station

	Balloon Position			Wind Velocity		
Time	X	Y	Z	U	V	VT
0700.00	.0	.0	.0			
0700.50	- 108.4	- 10.2	91.4	-3.61	- .34	3.63
0701.00	- 317.8	- 9.9	182.8	-6.97	.00	6.97
0701.50	- 518.8	- 39.0	274.3	-6.69	- .96	6.76
0702.00	- 626.2	- 137.6	365.7	-3.58	- 3.28	4.86
0702.50	- 707.5	- 254.7	457.2	-2.70	- 3.90	4.74
0703.00	- 754.8	- 364.8	548.6	-1.57	- 3.67	3.99
0703.50	- 788.1	- 482.9	640.0	-1.11	- 3.93	4.09
0704.00	- 811.2	- 602.5	731.5	- .77	- 3.98	4.05
0704.50	- 837.0	- 719.9	822.9	- .85	- 3.91	4.00
0705.00	- 850.1	- 841.2	914.4	- .43	- 4.04	4.06
0705.50	- 861.4	- 956.7	1005.8	- .37	- 3.84	3.86
0706.00	- 870.4	-1102.1	1097.2	- .30	- 4.84	4.85
0706.50	- 889.7	-1261.3	1188.7	- .64	- 5.30	5.34
0707.00	- 914.6	-1498.4	1280.1	- .82	- 7.90	7.94
0707.50	- 916.2	-1723.1	1371.6	- .05	- 7.49	7.49
0708.00	- 886.0	-1944.3	1463.0	1.00	- 7.37	7.44
0708.50	- 868.8	-2172.3	1554.4	.57	- 7.60	7.62
0709.00	- 860.2	-2363.5	1645.9	.28	- 6.37	6.37
0709.50	- 879.8	-2526.4	1737.3	- .65	- 5.43	5.47
0710.00	- 927.4	-2693.4	1828.8	-1.58	- 5.56	5.78
0710.50	- 987.4	-2835.5	1920.2	-2.00	- 4.73	5.14
0711.00	-1024.1	-2974.1	2011.6	-1.22	- 4.62	4.77
0711.50	-1017.7	-3113.8	2103.1	.21	- 4.65	4.65
0712.00	- 997.5	-3283.3	2194.5	.67	- 5.65	5.69
0712.50	- 995.1	-3447.5	2286.0	.08	- 5.47	5.47
0713.00	- 963.3	-3620.2	2377.3	1.06	- 5.75	5.85
0713.50	- 905.0	-3799.0	2468.8	1.94	- 5.95	6.26
0714.00	- 810.6	-3984.0	2560.3	3.14	- 6.16	6.92
0714.50	- 732.4	-4196.7	2651.7	2.60	- 7.08	7.55
0715.00	- 648.8	-4393.9	2743.2	2.78	- 6.57	7.13
0715.50	- 552.0	-4629.3	2834.6	3.22	- 7.84	8.48
0716.00	- 436.3	-4889.0	2926.0	3.85	- 8.65	9.47
0716.50	- 256.1	-5158.5	3017.5	6.00	- 8.98	10.80
0717.00	- 75.8	-5428.0	3108.9	6.00	- 8.98	10.80
0717.50	108.0	-5678.7	3200.3	6.16	- 8.35	10.38
0718.00	277.4	-5883.4	3291.8	5.61	- 6.82	8.83
0718.50	484.8	-6160.6	3383.2	6.91	- 9.23	11.53
0719.00	691.4	-6470.7	3474.7	6.88	-10.33	12.42
0719.50	901.5	-6816.7	3566.1	7.00	-11.53	13.49
0720.00	1095.1	-7157.4	3657.6	6.45	-11.35	13.06

Single Theodolite Data - 8 KM Station

	Balloon Position			Wind Velocity		
Time	X	Y	Z	U	V	VT
0730.00	.0	.0	.0			
0730.50	- 98.0	.1	91.4	-3.26	.00	3.26
0731.00	- 313.2	24.6	182.8	-7.17	.81	7.21
0731.50	- 551.0	41.4	274.3	-7.92	.55	7.94
0732.00	- 733.5	3.8	365.7	-6.08	- 1.25	6.21
0732.50	- 839.9	- 97.1	457.2	-3.54	- 3.36	4.89
0733.00	- 881.2	- 209.9	548.6	-1.37	- 3.75	4.00
0733.50	- 921.8	- 315.6	640.0	-1.35	- 3.52	3.77
0734.00	- 965.1	- 429.6	731.6	-1.44	- 3.80	4.06
0734.50	- 984.1	- 552.2	822.9	- .63	- 4.08	4.13
0735.00	- 987.7	- 651.2	914.4	- .11	- 3.29	3.30
0735.50	- 979.2	- 756.8	1005.8	- .28	- 3.52	3.53
0736.00	- 999.4	- 893.5	1097.2	- .67	- 4.55	4.60
0736.50	-1019.7	-1055.9	1188.7	- .67	- 5.41	5.45
0737.00	-1027.4	-1268.7	1280.1	- .25	- 7.09	7.09
0737.50	-1003.9	-1534.1	1371.6	.78	- 8.84	8.88
0738.00	- 980.8	-1784.1	1463.0	.76	- 8.33	8.36
0738.50	- 931.1	-2024.4	1554.4	1.65	- 8.00	8.17
0739.00	- 869.9	-2231.2	1645.9	2.04	- 6.89	7.18
0739.50	- 845.9	-2402.2	1737.3	.79	- 5.70	5.75
0740.00	- 859.0	-2582.3	1828.8	- .43	- 6.00	6.02
0740.50	- 920.5	-2751.2	1920.2	-2.05	- 5.62	5.98
0741.00	- 970.3	-2916.9	2011.2	-1.66	- 5.52	5.76
0741.50	-1006.9	-3117.3	2103.1	-1.21	- 6.67	6.78
0742.00	-1009.1	-3321.5	2194.5	- .07	- 6.80	6.80
0742.05	- 996.1	-3520.1	2286.0	.43	- 6.62	6.63
0743.00	- 962.8	-3696.1	2377.4	1.11	- 5.86	5.97
0743.50	- 899.2	-3894.9	2468.8	2.11	- 6.62	6.95
0744.00	- 819.4	-4063.7	2560.3	2.66	- 5.62	6.22
0744.50	- 734.8	-4299.0	2651.7	2.81	- 7.84	8.33
0745.00	- 666.9	-4516.4	2743.2	2.26	- 7.24	7.59
0745.50	- 578.1	-4777.3	2834.6	2.96	- 8.69	9.18
0746.00	- 483.8	-5024.4	2926.0	3.14	- 8.23	8.81
0746.50	- 370.6	-5298.8	3017.6	3.77	- 9.14	9.89
0747.00	- 234.9	-5603.7	3108.9	4.52	-10.16	11.12
0747.50	- 51.6	-5918.7	3200.4	6.10	-10.50	12.14
0748.00	97.6	-6216.4	3291.8	4.97	- 9.92	11.09
0748.50	270.9	-6465.9	3383.2	5.77	- 8.31	10.12
0749.00	448.0	-6746.1	3474.7	5.90	- 9.34	11.05
0749.50	614.4	-7090.2	3566.1	5.54	-11.46	12.73
0750.00	793.3	-7423.8	3657.6	5.96	-11.11	12.61

Single Theodolite Data - 8 KM Station

	Balloon Position			Wind Velocity		
Time	X	Y	Z	U	V	VT
0800.00	.0	.0	.0			
0800.50	- 138.1	3.6	91.4	-4.60	.12	4.60
0801.00	- 304.0	30.3	182.8	-5.53	.89	5.60
0801.50	- 434.0	53.2	274.3	-4.33	.76	4.39
0802.00	- 661.0	75.3	365.7	-7.56	.73	7.60
0802.50	- 860.3	73.7	457.2	-6.64	- .05	6.64
0803.00	- 977.6	- 3.4	548.6	-3.91	-2.57	4.68
0803.50	-1030.8	- 106.5	640.0	-1.77	-3.43	3.86
0804.00	-1068.6	- 207.7	731.5	-1.25	-3.37	3.59
0804.50	-1092.6	- 282.5	822.9	- .79	-2.49	2.62
0805.00	-1106.3	- 355.2	914.4	- .45	-2.42	2.46
0805.50	-1124.8	- 449.9	1005.8	- .61	-3.15	3.21
0806.00	-1145.4	- 611.5	1097.2	- .68	-5.38	5.43
0806.50	-1148.7	- 837.6	1188.7	- .11	-7.53	7.53
0807.00	-1115.2	-1080.7	1280.1	1.11	-8.10	8.17
0807 50	-1073.5	-1325.7	1371.6	1.38	-8.16	8.28
0808.00	-1025.8	-1526.6	1463.0	1.59	-6.69	6.88
0808.50	- 999.0	-1695.9	1554.4	.89	-5.64	5.71
0809.00	-1030.4	-1828.7	1645.9	-1.04	-4.42	4.55
0809.50	-1092.7	-1955.1	1737.3	-2.07	-4.21	4.69
0810.00	-1160.7	-2111.3	1828.8	-2.26	-5.20	5.67
0810.50	-1206.3	-2297.6	1920.2	-1.51	-6.21	6.39
0811.00	-1226.9	-2493.4	2011.6	- .68	-6.52	6.56
0811.50	-1227.5	-2668.8	2103.1	- .01	-5.84	5.84
0812.00	-1220.5	-2861.5	2194.5	.23	-6.42	6.42
0812.50	-1195.6	-3050.9	2286.0	.82	-6.31	6.36
0813.00	-1174.8	-3281.1	2377.4	.69	-7.67	7.70
0813.50	-1151.9	-3503.4	2468.8	.76	-7.40	7.44
0814.00	-1100.6	-3739.1	2560.3	1.71	-7.85	8.04
0814.50	-1042.2	-4029.8	2651.7	1.94	-9.69	9.88
0815.00	- 953.9	-4302.6	2743.2	2.94	-9.09	9.55
0815.50	- 872.4	-4617.3	2834.6	2.71	-10.48	10.83
0816.00	- 717.1	-4915.4	2926.0	5.17	-9.93	11.20
0816.50	- 589.3	-5172.0	3017.5	4.26	-8.55	9.55
0817.00	- 427.6	-5433.7	3108.9	5.38	-8.72	10.25
0817.50	- 298.6	-5695.2	3200.4	4.30	-8.71	9.72
0818.00	- 156.7	-5985.7	3291.8	4.72	-9.68	10.77
0818.50	- .0	-6257.2	3383.2	5.22	-9.04	10.44
0819.00	136.8	-6533.5	3474.7	4.56	-9.21	10.27
0819.50	258.9	-6832.7	3566.1	4.07	-9.97	10.77
0820.00	397.2	-7105.8	3657.6	4.60	-9.10	10.20

Single Theodolite Data - 8 KM Station

	Balloon Position			Wind Velocity		
Time	X	Y	Z	U	V	VT
0830.00	.0	.0	.0			
0830.50	- 55.5	14.1	91.4	-1.85	.47	1.91
0831.00	-126.9	6.2	182.8	-2.37	- .26	2.39
0831.50	-251.5	19.3	274.3	-4.15	.43	4.17
0832.00	-407.3	15.6	365.7	-5.19	- .12	5.19
0832.50	-528.1	-39.7	457.2	-4.02	-1.84	4.43
0833.00	-599.4	- 120.8	548.6	-2.37	-2.70	3.59
0833.50	-654.1	- 199.9	640.0	-1.82	-2.63	3.20
0834.00	-704.6	- 263.4	731.5	-1.68	-2.11	2.70
0834.50	-734.5	- 331.6	822.9	- .99	-2.26	2.48
0835.00	-782.7	- 428.6	914.4	-1.60	-3.22	3.60
0835.50	-814.7	- 589.7	1005.8	-1.06	-5.37	5.48
0836.00	-830.1	- 793.2	1097.2	- .51	-6.78	6.80
0836.50	-819.2	-1011.6	1188.7	.36	-7.28	7.27
0837.00	-790.8	-1217.7	1280.1	.94	-6.86	6.93
0837.50	-758.4	-1402.7	1371.6	1.07	-6.16	6.25
0838.00	-731.9	-1555.4	1463.0	.88	-5.09	5.16
0838.50	-765.3	-1687.9	1554.4	-1.11	-4.38	4.52
0839.00	-825.2	-1802.5	1645.9	-1.99	-3.84	4.33
0839.50	-892.9	-1959.2	1737.3	-2.25	-5.22	5.68
0840.00	-948.9	-2121.4	1828.8	-1.86	-5.40	5.71
0840.50	-959.8	-2272.2	1920.2	- .36	-5.02	5.04
0841.00	-978.4	-2483.8	2011.6	- .61	-7.05	7.07
0841.50	-966.3	-2683.9	2103.1	.40	-6.67	6.68
0842.00	-950.4	-2890.5	2194.5	.53	-6.88	6.90
0842.50	-961.8	-3107.1	2286.0	- .38	-7.21	7.22
0843.00	-944.1	-3314.4	2377.3	.58	-6.90	6.93
0843.50	-917.1	-3572.0	2468.8	.89	-8.58	8.63
0844.00	-863.4	-3831.4	2560.3	1.79	-8.64	8.82
0844.50	-800.4	-4117.5	2651.7	2.10	-9.53	9.76
0845.00	-687.1	-4388.1	2743.2	3.77	-9.01	9.77
0845.50	-580.8	-4662.9	2834.6	3.54	-9.16	9.82
0846.00	-474.2	-4924.9	2926.9	3.55	-8.73	9.42
0846.50	-381.2	-5191.4	3017.5	3.09	-8.88	9.41
0847.00	-287.6	-5487.6	3108.9	3.12	-9.86	10.34
0847.50	-181.3	-5770.8	3200.4	3.54	-9.44	10.08
0848.00	-105.8	-6061.8	3291.8	2.51	-9.70	10.02
0848.50	- 22.3	-6389.8	3383.2	2.78	-10.93	11.28
0849.00	93.1	-6674.2	3474.7	3.84	-9.47	10.23
0849.50	193.7	-6968.1	3566.1	3.35	-9.79	10.35
0850.00	317.1	-7265.3	3657.6	4.11	-9.90	10.72

Single Theodolite Data - 8 KM Station

	Balloon Position			Wind Velocity		
Time	X	Y	Z	U	V	VT
0900.00	.0	.0	.0			
0900.50	- 66.3	29.1	91.4	-2.21	.97	2.41
0901.00	-121.0	30.1	182.8	-1.82	.03	1.82
0901.50	-208.6	33.0	274.3	-2.92	.09	2.92
0902.00	-346.6	44.4	365.7	-4.60	.37	4.61
0902.50	-496.8	17.3	457.2	-5.00	- .90	5.08
0903.00	-593.3	-38.3	548.6	-3.21	-1.85	3.71
0903.50	-659.6	- 102.1	640.9	-2.20	-2.12	3.06
0904.00	-711.8	- 168.2	731.5	-1.74	-2.20	2.81
0904.50	-741.7	- 216.8	822.9	- .99	-1.62	1.90
0905.00	-761.6	- 272.6	914.4	- .66	-1.86	1.97
0905.50	-791.1	- 372.2	1005.8	- .98	- 3.31	3.46
0906.00	-795.4	- 526.4	1097.2	- .14	-5.13	5.14
0906.50	-744.8	- 731.9	1188.7	1.68	-6.85	7.05
0907.00	-744.8	- 869.0	1280.1	- .00	-4.56	4.56
0907.50	-711.1	-1030.9	1371.6	1.12	-5.39	5.51
0908.00	-691.0	-1187.4	1463.0	.66	-5.21	5.25
0908.50	-702.4	-1326.6	1554.4	- .37	-4.64	4.65
0909.00	-744.4	-1442.3	1645.9	-1.40	-3.85	4.10
0909.50	-809.9	-1523.3	1737.3	-2.18	-2.70	3.47
0910.00	-862.0	-1641.9	1828.8	-1.73	-3.95	4.31
0910.50	-899.7	-1804.5	1920.2	-1.25	-5.42	5.56
0911.00	-927.8	-1989.6	2011.6	- .93	-6.16	6.23
0911.50	-926.1	-2171.2	2103.1	.05	-6.05	6.05
0912.00	-930.0	-2385.5	2194.5	- .13	-7.14	7.14
0912.50	-955.3	-2582.4	2286.0	- .84	-6.56	6.61
0913.00	-943.1	-2802.4	2377.4	.40	-7.33	7.34
0913.50	-930.5	-3043.7	2468.8	.41	-8.04	8.05
0914.00	-897.3	-3302.7	2560.3	1.10	-8.63	8.70
0914.50	-867.7	-3586.8	2651.7	.98	-9.47	9.52
0915.00	-786.9	-3867.6	2743.2	2.69	-9.36	9.74
0915.50	-739.1	-4234.9	2834.6	1.59	-12.24	12.34
0916.00	-627.6	-4410.0	2926.0	3.71	-5.83	6.92
0916.50	-542.3	- 4687.0	3017.5	2.84	-9.23	9.66
0917.00	-450.9	-4954.8	3108.9	3.04	-8.92	9.43
0917.50	-384.9	-5228.9	3200.4	2.23	-9.13	9.40
0918.00	-346.7	-5511.1	3291.8	1.24	-9.40	9.48
0918.50	-304.2	-5805.0	3383.2	1.41	-9.79	9.89
0919.00	-202.8	-6113.2	3474.7	3.38	-10.27	10.81
0919.50	-109.5	- 6415.4	3566.1	3.10	-10.07	10.54
0920.00	- 11.8	-6736.4	3657.6	3.25	-10.69	11.18

Single Theodolite Data - 8 KM Station

	Balloon Position			Wind Velocity		
Time	X	Y	Z	U	V	VT
0930.00	.0	.0	.0			
0930.50	- 124.2	20.1	91.4	-4.14	.67	4.19
0931.00	- 249.7	9.1	182.8	-4.18	- .36	4.19
0931.50	- 388.4	- 18.9	274.3	-4.62	- .93	4.71
0932.00	- 551.1	- 40.4	365.7	-5.42	- .71	5.47
0932.50	- 667.5	- 59.5	457.2	-3.88	- .63	3.93
0933.00	- 764.3	- 85.7	548.6	-3.22	- .87	3.34
0933.50	- 853.4	- 119.9	640.9	-2.97	-1.14	3.18
0934.00	- 900.7	- 102.6	731.5	-1.57	-.57	1.67
0934.50	- 935.5	- 144.8	822.9	-1.16	-1.40	1.82
0935.00	- 990.2	- 208.6	914.4	-1.82	-2.12	2.80
0935.50	-1043.8	- 256.3	1005.8	-1.78	-1.59	2.39
0936.00	-1088.0	- 340.9	1097.2	-1.47	-2.81	3.18
0936.50	-1092.8	- 457.1	1188.7	- .15	-3.87	3.87
0937.00	-1116.9	- 539.9	1280.1	- .80	-2.75	2.87
0937.50	-1124.2	- 664.8	1371.6	- .24	-4.16	4.17
0938.00	-1118.2	- 806.4	1463.0	.20	-4.71	4.72
0938.50	-1105.5	- 961.0	1554.4	.42	-5.15	5.16
0939.00	-1117.9	-1098.5	1645.9	- .41	-4.58	4.60
0939.50	-1151.0	-1204.4	1737.3	-1.10	-3.53	3.69
0940.00	-1207.5	-1254.8	1828.8	-1.88	-1.67	2.52
0940.50	-1273.8	-1356.4	1920.2	-2.20	-3.38	4.04
0941.00	-1336.7	-1484.5	2011.6	-2.09	-4.26	4.75
0941.50	-1394.7	-1633.0	2103.1	-1.93	-4.95	5.31
0942.00	-1445.2	-1784.6	2194.5	-1.68	-5.05	5.32
0942.50	-1470.1	-1950.9	2286.0	- .83	-5.54	5.60
0943.00	-1497.1	-2130.1	2377.3	- .89	-5.97	6.04
0943.50	-1536.1	-2294.5	2468.8	-1.29	-5.48	5.63
0944.00	-1538.9	-2462.8	2560.3	- .09	-5.60	5.60
0944.50	-1567.3	-2692.8	2651.7	- .94	-7.66	7.72
0945.00	-1573.0	-2945.9	2743.2	- .18	-8.43	8.43
0945.50	-1567.8	-3228.7	2834.2	.17	-9.42	9.42
0946.00	-1537.7	-3519.7	2926.0	1.00	-9.70	9.75
0946.50	-1500.0	-3808.0	3017.5	1.25	-9.60	9.69
0947.00	-1442.4	-4095.9	3108.9	1.92	-9.59	9.78
0947.50	-1478.4	-4342.8	3200.4	-1.20	-8.23	8.31
0948.00	-1383.8	-4641.8	3291.8	3.15	-9.96	10.45
0948.50	-1402.4	-4955.9	3383.2	-.61	-10.46	10.48
0949.00	-1387.9	-5252.9	3474.7	.48	-9.90	9.91
0949.50	-1301.2	-5541.2	3566.1	2.89	-9.60	10.03
0950.00	-1220.6	-5842.4	3657.6	2.68	-10.04	10.39

Single Theodolite Data - 8 KM Station

	Balloon Position			Wind Velocity		
Time	X	Y	Z	U	V	VT
1000.00	.0	.0	.0			
1000.50	- 113.3	- 29.3	91.4	-3.77	- .97	3.90
1001.00	- 218.8	- 61.9	182.8	-3.51	-1.08	3.68
1001.50	- 268.7	- 67.9	274.3	-1.66	- .20	1.67
1002.00	- 318.9	- 60.8	365.7	-1.67	.23	1.69
1002.50	- 357.4	- 91.1	457.2	-1.28	-1.00	1.63
1003.00	- 368.3	-123.2	548.6	- .36	-1.07	1.13
1003.50	- 409.4	-156.3	640.0	-1.36	-1.10	1.75
1004.00	- 446.0	-188.4	731.5	-1.21	-1.06	1.62
1004.50	- 480.9	-237.6	822.9	-1.16	-1.64	2.01
1005.00	- 496.3	- 300.6	914.4	- .51	-2.09	2.15
1005.50	- 519.8	- 353.2	1005.8	- .78	-1.75	1.92
1006.00	- 551.6	- 429.4	1097.2	-1.05	-2.53	2.74
1006.50	- 576.3	-513.5	1188.7	- .82	-2.80	2.92
1007.00	- 603.0	-617.9	1280.1	- .88	-3.48	3.59
1007.50	- 642.8	-684.6	1371.6	-1.32	-2.22	2.58
1008.00	- 687.0	-744.5	1463.9	-1.47	-1.99	2.47
1008.50	- 767.4	-822.9	1554.4	-2.68	-2.61	3.74
1009.00	- 857.9	-933.0	1645.9	-3.01	-3.66	4.75
1009.50	- 946.8	-1040.6	1737.3	-2.96	-3.58	4.65
1010.00	-1022.0	-1159.2	1828.8	-2.50	-3.95	4.68
1010.50	-1079.8	-1296.0	1920.2	-1.92	-4.56	4.95
1011.00	-1127.2	-1458.4	2011.6	-1.58	-5.41	5.64
1011.50	-1174.6	-1604.8	2103.1	-1.57	-4.87	5.12
1012.00	-1204.8	-1779.5	2194.5	-1.00	-5.82	5.90
1012.50	-1246.4	-1964.1	2286.0	-1.38	-6.15	6.30
1013.00	-1265.2	-2182.6	2377.4	- .62	-7.28	7.31
1013.50	-1282.7	-2412.5	2468.8	- .58	-7.66	7.68
1014.00	-1272.6	-2656.1	2560.3	.33	-8.12	8.12
1014.50	-1260.1	-2898.1	2651.7	.41	-8.06	8.07
1015.00	-1238.2	-3127.2	2743.2	.73	-7.63	7.67
1015.50	-1236.3	-3342.2	2834.6	.06	-7.16	7.16
1016.00	-1243.3	-3590.3	2926.0	- .23	-8.27	8.27
1016.50	-1215.2	-3830.8	3017.5	.93	-8.01	8.06
1017.00	-1170.8	-4083.2	3108.9	1.47	-8.41	8.54
1017.50	-1135.2	-4357.9	3200.4	1.18	-9.15	9.23
1018.00	-1065.4	-4614.9	3291.8	2.32	-8.56	8.87
1018.50	- 963.3	-4865.2	3383.2	3.40	-8.34	9.01
1019.00	- 835.6	-5102.9	3474.7	4.25	-7.92	8.99
1019.50	- 685.2	-5380.4	3566.1	5.01	-9.25	10.52
1020.00	- 520.2	-5608.1	3657.6	5.49	-7.58	9.36

Single Theodolite Data - 8 KM Station

	Balloon Position			Wind Velocity		
Time	X	Y	Z	U	V	VT
1030.00	.0	.0	.0			
1030.50	- 12.0	-10.4	91.4	- .40	- .34	.53
1031.00	- 45.9	11.4	182.8	-1.12	.73	1.34
1031.50	- 79.7	33.3	274.3	-1.12	.73	1.34
1032.00	-127.0	16.4	365.7	-1.57	- .56	1.67
1032.50	-166.1	8.4	457.2	-1.30	- .26	1.33
1033.00	-209.2	10.6	548.6	-1.43	.07	1.43
1033.50	-224.9	28.0	640.0	- .52	.58	.78
1034.00	-247.5	-2.5	731.6	- .75	-1.02	1.25
1034.50	-290.4	-49.6	822.9	-1.42	-1.56	2.12
1035.00	-335.7	-108.4	914.4	-1.51	-1.95	2.47
1035.50	-384.3	-160.7	1005.8	-1.62	-1.74	2.38
1036.00	-432.9	-183.7	1097.2	-1.61	- .76	1.79
1036.50	-505.6	-201.2	1188.7	-2.42	- .58	2.49
1037.00	-577.6	-236.9	1280.1	-2.40	-1.18	2.67
1037.50	-660.9	-308.2	1371.6	-2.77	-2.37	3.65
1038.00	-743.6	-378.8	1463.9	-2.75	-2.35	3.62
1038.50	-836.3	-455.9	1554.4	-3.09	-2.57	4.02
1039.00	-918.1	-547.2	1645.9	-2.72	-3.04	4.08
1039.50	-1006.9	-666.4	1737.3	-2.95	-3.97	4.95
1040.00	-1101.5	-794.4	1828.8	-3.15	-4.26	5.30
1040.50	-1182.2	-923.6	1920.2	-2.68	-4.30	5.07
1041.00	-1248.3	-1073.6	2011.6	-2.20	-5.00	5.46
1041.50	-1346.1	-1246.5	2103.1	-3.26	-5.76	6.62
1042.00	-1436.8	-1216.9	2194.5	-3.02	-5.67	6.43
1042.50	-1500.6	-1598.9	2286.0	-2.12	-6.03	6.40
1043.00	-1532.3	-1806.8	2377.4	-1.05	-6.96	7.04
1043.50	-1540.1	-2007.1	2468.8	- .25	-6.67	6.68
1044.00	-1542.1	-2202.3	2560.3	- .06	-6.50	6.50
1044.50	-1537.4	-2404.9	2651.7	.15	-6.72	6.72
1045.00	-1543.6	-2589.5	2743.2	- .20	-6.18	6.18
1045.50	-1553.3	-2802.2	2834.6	- .32	-7.09	7.09
1046.00	-1533.7	-3023.0	2926.0	.65	-7.36	7.39
1046.50	-1525.7	-3242.3	3017.5	.26	-7.30	7.31
1047.00	-1509.2	-3470.9	3108.9	.55	-7.62	7.64
1047.50	-1457.6	-3719.3	3200.4	1.72	-8.27	8.45
1048.00	-1399.5	-3974.1	3291.8	1.93	-8.49	8.71
1048.50	-1303.8	-4211.9	3383.2	3.18	-7.92	8.54
1049.00	-1193.4	-4453.9	3474.7	3.67	-8.06	8.86
1049.50	-1054.8	-4720.7	3566.1	4.62	-8.89	10.02
1050.00	-915.5	-4988.0	3657.6	4.64	-8.90	10.04

Single Theodolite Data - 8 KM Station

	Balloon Position			Wind Velocity		
Time	X	Y	Z	U	V	VT
1230.00	.0	.0	.0			
1230.50	- 70.1	28.3	91.4	-2.33	.94	2.52
1231.00	- 117.7	30.9	182.8	-1.58	.08	1.58
1231.50	- 165.3	33.6	274.3	-1.58	.08	1.58
1232.00	- 230.6	33.2	365.7	-2.17	- .01	2.17
1232.50	- 314.9	31.9	457.2	-2.81	- .04	2.81
1233.00	- 384.2	32.2	548.6	- 2.30	.00	2.30
1233.50	- 451.4	- 6.2	640.0	-2.24	-1.28	2.58
1234.00	- 553.8	- 38.7	731.6	- 3.41	-1.08	3.58
1234.50	- 655.1	- 108.4	822.9	-3.37	-2.32	4.09
1235.00	- 759.8	- 106.7	914.4	-3.48	.05	3.48
1235.50	- 848.2	- 54.8	1005.8	-2.94	1.73	3.41
1236.00	- 894.6	- 24.9	1097.2	-1.54	.99	1.83
1236.50	- 936.0	- 72.0	1188.7	-1.38	-1.56	2.08
1237.00	- 987.0	- 69.0	1280.1	-1.69	.10	1.70
1237.50	-1067.2	- 33.5	1371.6	-2.67	1.18	2.92
1238.00	-1159.6	- 6.0	1463.0	-3.07	.91	3.21
1238.50	-1263.2	6.6	1554.4	-3.45	.42	3.48
1239.00	-1376.1	.0	1645.9	-3.76	- .22	3.77
1239.50	-1499.4	- 20.9	1737.3	-4.10	- .69	4.16
1240.00	-1605.3	- 64.4	1828.8	-3.52	-1.45	3.81
1240.50	-1718.3	- 126.1	1920.2	-3.76	-2.05	4.29
1241.00	-1820.6	- 111.3	2011.6	-3.41	.49	3.44
1241.50	-1917.9	- 188.0	2103.1	-3.24	-2.55	4.12
1242.00	-1996.3	- 294.7	2194.5	-2.61	-3.55	4.41
1242.50	-2041.8	- 396.8	2286.0	-1.51	-3.40	3.72
1243.00	-2051.6	- 496.3	2377.4	- .32	-3.31	3.33
1243.50	-2081.7	- 581.2	2468.8	-1.00	-2.82	3.00
1244.00	-2101.8	- 731.9	2560.3	- .67	-5.02	5.06
1244.50	-2139.4	- 882.8	2651.7	-1.25	-5.02	5.18
1245.00	-2177.0	-1033.6	2743.2	-1.25	-5.02	5.18
1245.50	-2220.9	-1220.9	2834.6	-1.46	-6.24	6.41
1246.00	-2218.6	-1386.3	2926.0	.07	-5.51	5.51
1246.50	-2196.9	-1549.7	3017.5	.72	-5.44	5.49
1247.00	-2149.6	-1716.0	3108.9	1.57	-5.54	5.76
1247.50	-2090.9	-1909.2	3200.4	1.95	- 6.44	6.73
1248.00	-2041.9	-2106.1	3291.8	1.66	-6.56	6.77
1248.50	-1967.4	-2311.7	3383.2	2.45	-6.85	7.27
1249.00	-1902.6	-2497.4	2474.7	2.16	-6.19	6.55
1249.50	-1809.6	-2680.3	3566.1	3.09	-6.09	6.83
1250.00	-1710.1	-2868.7	3657.6	3.31	-6.28	7.10

Single Theodolite Data - 8 KM Station

	Balloon Position			Wind Velocity		
Time	X	Y	Z	U	V	VT
1300.00	0.0	.0	.0			
1300.50	- 78.9	- 89.8	91.4	-2.63	-2.99	3.98
1301.00	-141.0	- 115.4	182.8	-2.06	- .85	2.23
1301.50	-205.5	- 108.8	274.3	-2.15	.21	2.16
1302.00	-268.6	- 84.6	365.7	-2.10	.80	2.25
1302.50	-323.3	- 86.0	457.2	-1.82	- .04	1.82
1303.00	-390.5	- 99.6	548.6	-2.23	- .45	2.28
1303.50	-459.2	- 108.5	640.9	-2.29	- .30	2.31
1304.00	-553.4	- 104.5	731.5	-3.14	.13	3.14
1304.50	-647.2	- 80.6	822.9	-3.12	.79	3.22
1305.00	-753.9	- 61.9	914.4	-3.55	.62	3.60
1305.50	-794.1	- 19.3	1005.8	-1.34	1.41	1.95
1306.00	-847.8	20.7	1097.2	-1.78	1.33	2.23
1306.50	-908.1	34.8	1188.7	-2.01	.47	2.06
1307.00	-966.6	54.0	1280.1	-1.94	.63	2.05
1307.50	-1029.9	86.4	1371.6	-2.10	1.08	2.37
1308.00	-1120.0	121.6	1463.0	-3.00	1.17	3.22
1308.50	-1223.8	141.6	1554.4	-3.45	.66	3.52
1309.00	-1340.9	138.4	1645.9	-3.87	- .10	3.87
1309.50	-1456.4	137.6	1737.3	-3.88	- .02	3.88
1310.00	-1574.1	118.3	1828.8	-3.92	- .64	3.97
1310.50	-1665.3	113.5	1920.2	-3.04	- .16	3.04
1311.00	-1764.5	98.6	2011.6	-3.30	- .49	3.34
1311.50	-1847.4	29.0	2103.1	-2.76	-2.32	3.60
1312.00	-1920.4	- 53.6	2194.5	-2.43	-2.75	3.67
1312.50	-1941.9	- 132.3	2286.0	- .68	-2.62	2.71
1313.00	-1942.5	- 200.7	2377.4	- .04	-2.28	2.28
1313.50	-1949.2	- 291.2	2468.8	- .22	-3.01	3.02
1314.00	-1947.3	- 424.5	2560.3	.06	-4.44	4.44
1314.50	-1962.0	- 566.2	2651.7	- .48	-4.72	4.74
1315.00	-1991.0	- 728.6	2743.2	- .96	-5.41	5.49
1315.50	-2028.9	- 907.5	2834.6	-1.26	-5.96	6.09
1316.00	-2023.9	-1080.6	2926.0	.16	-5.76	5.77
1316.50	-1989.2	-1233.3	3017.5	1.16	-5.09	5.22
1317.00	-1948.6	-1420.8	3108.9	1.35	-6.24	6.39
1317.50	-1902.9	-1608.0	3200.4	1.51	-6.24	6.42
1318.00	-1843.8	-1792.9	3291.8	1.97	-6.16	6.47
1318.50	-1768.2	-1977.5	3383.2	2.51	-6.15	6.64
1319.00	-1677.3	-2146.9	3474.7	3.02	-5.64	6.40
1319.50	-1581.1	-2327.4	3566.1	3.20	-6.01	6.81
1320.00	-1481.0	-2504.2	3657.6	3.33	-5.89	6.77

Single Theodolite Data - 8 KM Station

	Balloon Position			Wind Velocity		
Time	X	Y	Z	U	V	VT
1600.00	.0	.0	.0			
1600.50	171.8	- 90.6	91.4	5.72	-3.02	6.47
1601.00	292.9	-160.4	182.8	4.03	-2.32	4.65
1601.50	355.0	-191.9	274.3	2.06	-1.05	2.32
1602.00	356.2	-234.9	365.7	.03	-1.43	1.43
1602.50	325.9	-279.3	457.2	-1.00	-1.48	1.79
1603.00	323.2	-325.6	548.6	- .09	-1.53	1.53
1603.50	344.3	-382.4	640.9	.70	-1.89	2.02
1604.00	369.7	-373.6	731.5	.84	.29	.89
1604.50	346.5	-366.4	822.9	- .77	.24	.81
1605.00	340.9	-358.0	914.4	- .18	.27	.33
1605.50	282.9	-300.2	1005.8	-1.93	1.92	2.73
1606.00	146.8	-259.4	1097.2	-4.53	1.35	4.73
1606.50	- 7.7	-261.2	1188.7	-5.15	- .05	5.15
1607.00	-149.2	-252.3	1280.1	-4.71	.29	4.72
1607.50	-294.6	-252.5	1371.6	-4.84	- .00	4.84
1608.00	-402.9	-208.4	1463.0	-3.57	1.47	3.87
1608.50	-469.4	-105.7	1554.4	-2.24	3.42	4.09
1609.00	-484.2	11.8	1645.9	- .49	3.92	3.95
1609.50	-507.2	119.9	1737.3	- .76	3.60	3.68
1610.00	-561.2	234.7	1828.8	-1.79	3.82	4.23
1610.50	-623.6	340.0	1920.2	-2.08	3.50	4.07
1611.00	-663.6	447.6	2011.6	-1.33	3.58	3.82
1611.50	-713.5	543.6	2103.1	-1.66	3.19	3.60
1612.00	-755.0	620.1	2194.5	-1.38	2.55	2.90
1612.50	-788.7	643.2	2286.0	-1.12	.76	1.36
1613.00	-851.9	628.1	2377.4	-2.10	- .50	2.16
1613.50	-861.1	570.0	2468.8	- .30	-1.93	1.96
1614.00	-842.2	486.2	2560.3	.63	-2.79	2.86
1614.50	-853.2	363.2	2651.7	- .36	-4.10	4.11
1615.00	-878.3	227.1	2743.2	- .83	-4.53	4.61

Single Theodolite Data - 8 KM Station

	Balloon Position			Wind Velocity		
Time	X	Y	Z	U	V	VT
2000.00	.0	.0	.0			
2000.50	2.2	- 71.9	91.4	.07	-2.37	2.39
2001.00	- 66.5	-137.6	182.8	-2.29	-3.19	3.17
2001.50	- 171.0	-174.6	274.3	-3.48	-1.23	3.69
2002.00	- 284.1	-205.6	365.7	-3.77	-1.03	3.91
2002.50	- 407.7	-230.7	457.2	-4.12	- .83	4.20
2003.00	- 551.2	-244.2	548.6	-4.78	- .45	4.80
2003.50	- 673.1	-271.9	640.0	-4.06	- .92	4.16
2004.00	- 804.6	-284.8	731.5	-4.37	- .43	4.39
2004.50	- 923.4	-298.2	822.9	-3.96	- .44	3.98
2005.00	-1047.3	-286.5	914.4	-4.13	.39	4.15
2005.50	-1179.0	-259.2	1005.8	-4.38	.90	4.48
2006.00	-1326.9	-222.0	1097.2	-4.92	1.23	5.08
2006.50	-1493.6	-186.0	1188.7	-5.55	1.20	5.68
2007.00	-1666.9	-157.6	1280.1	-5.77	.94	5.85
2007.50	-1835.8	-125.1	1371.6	-5.63	1.08	5.73
2008.00	-1967.9	- 89.3	1463.0	-4.40	1.19	4.56
2008.50	-2018.3	- 28.1	1554.4	-1.67	2.03	2.64
2009.00	-1996.2	41.8	1645.9	.73	2.33	2.44
2009.50	-1937.9	142.3	1737.3	1.94	3.34	3.87
2010.00	-1853.9	224.3	1828.8	2.79	2.73	3.91
2010.50	-1776.8	342.1	1920.2	2.56	3.92	4.69
2011.00	-1739.5	404.8	2011.6	1.24	2.08	2.43
2011.50	-1714.4	491.6	2103.1	.83	2.89	3.01
2012.00	-1705.3	564.0	2194.5	.30	2.41	2.43
2012.50	-1740.9	589.3	2286.0	-1.18	.84	1.45
2013.00	-1820.2	605.5	2377.4	-2.64	.54	2.69
2013.50	-1902.4	614.5	2468.8	-2.74	.29	2.75
2014.00	-1952.6	578.4	2560.3	-1.67	-1.20	2.06
2014.50	-1970.8	523.4	2651.7	- .60	-1.83	1.92
2015.00	-1980.1	479.0	2743.2	- .30	-1.48	1.51

Single Theodolite Data - 16 KM, Station

	Balloon Position			Wind Velocity		
Time	X	Y	Z	U	V	VT
1700.00	.0	.0	.0			
1700.50	- 66.1	-29.5	91.4	-2.20	- .98	2.41
1701.00	- 134.6	-59.1	182.8	-2.28	- .98	2.48
1701.50	- 214.4	-90.1	274.3	-2.66	-1.03	2.85
1702.00	- 282.3	-72.8	365.6	-2.26	.57	2.33
1702.50	- 350.2	-55.4	457.2	-2.26	.57	2.33
1793.00	- 421.1	-49.4	548.6	-2.36	.20	2.37
1703.50	- 514.8	-59.5	640.0	-3.12	- .33	3.14
1704.00	- 613.9	-72.1	731.5	-3.30	- .41	3.32
1704.50	- 714.2	-72.5	822.9	-3.34	- .01	3.34
1705.00	- 802.0	-81.4	914.4	-2.92	- .29	2.94
1705.50	- 877.5	-72.1	1005.8	-2.51	.31	2.53
1706.00	- 942.9	-39.5	1097.2	-2.17	1.08	2.43
1706.50	-1021.8	-35.6	1188.7	-2.62	.12	2.63
1707.00	-1112.2	-36.8	1280.1	-3.01	- .04	3.01
1707.50	-1204.9	- 2.0	1371.6	-3.09	1.15	3.30
1708.00	-1279.9	46.9	1463.0	-2.49	1.63	2.98
1708.50	-1383.4	65.2	1554.4	-3.45	.61	3.50
1709.00	-1462.5	107.4	1645.9	-2.63	1.40	2.98
1709.50	-1549.7	168.3	1737.3	-2.90	2.03	3.54
1710.00	-1632.0	293.6	1828.8	-2.74	4.17	4.99
1710.50	-1690.1	418.2	1920.2	-1.93	4.15	4.58
1711.00	-1666.4	509.4	2011.6	.79	3.04	3.14
1711.50	-1643.4	607.9	2103.1	.76	3.28	3.36
1712.00	-1645.0	705.1	2194.5	- .05	3.23	3.23
1712.50	-1698.9	735.2	2286.0	-1.79	1.00	2.05
1713.00	-1758.2	696.1	2377.4	-1.97	-1.30	2.36
1713.50	-1817.1	647.0	2468.8	-1.96	-1.63	2.55
1714.00	-1785.1	569.7	2560.3	1.06	-2.57	2.78
1714.50	-1792.1	485.6	2651.7	- .23	-2.80	2.81
1715.00	-1799.6	398.9	2743.2	- .25	-2.88	2.89

Single Theodolite Data - 16 KM Station

	Balloon Position			Wind Velocity		
Time	X	Y	Z	U	V	VT
1730.00	- .0	.0	.0			
1730.50	- 94.5	- 20.2	91.4	-3.15	- .67	3.22
1731.00	- 123.0	- 40.4	182.8	- .94	- .67	1.16
1731.50	- 180.5	- 51.7	274.3	-1.91	- .37	1.95
1732.00	- 257.8	- 75.4	365.7	-2.57	- .78	2.69
1732.50	- 355.1	-141.3	457.2	-3.24	-2.19	3.91
1733.00	- 477.8	-177.7	548.6	-4.08	-1.21	4.26
1733.50	- 613.4	-182.8	640.0	-4.51	- .17	4.52
1734.00	- 670.9	-168.5	731.5	-1.91	.47	1.97
1734.50	- 719.4	-154.2	822.9	-1.61	.47	1.68
1735.00	- 790.6	-125.2	914.4	-2.37	.96	2.56
1735.50	- 874.4	- 71.8	1005.8	-2.79	1.77	3.31
1736.00	- 960.1	- 30.1	1097.2	-2.85	1.39	3.17
1736.50	-1036.8	16.2	1188.7	-2.55	1.54	2.99
1737.00	-1111.2	58.2	1280.1	-2.48	1.39	2.84
1737.50	-1238.5	112.7	1371.6	-4.24	1.81	4.61
1738.00	-1383.5	162.5	1463.0	-4.83	1.66	5.11
1738.50	-1506.6	217.1	1554.4	-4.09	1.81	4.48
1739.00	-1631.2	293.5	1645.9	-4.15	2.54	4.87
1739.50	-1752.9	375.8	1737.3	-4.05	2.74	4.89
1740.00	-1846.3	450.1	1828.8	-3.11	2.47	3.97
1740.50	-1953.0	501.4	1920.2	-3.55	1.71	3.94
1741.00	-2059.2	590.4	2011.6	-3.53	2.96	4.61
1741.50	-2147.3	689.4	2103.1	-2.93	3.29	4.41
1742.00	-2139.2	812.6	2194.5	.26	4.10	4.11
1742.50	-2110.3	939.6	2286.0	.96	4.23	4.34
1743.00	-2077.9	1067.9	2377.4	1.08	4.27	4.41
1743.50	-2084.3	1174.5	2468.8	- .21	3.55	3.55
1744.00	-2106.7	1260.8	2560.3	- .74	2.87	2.97
1744.50	-2133.7	1278.2	2651.7	- .89	.57	1.06
1745.00	-2163.6	1279.5	2743.2	- .99	.04	.99

Single Theodolite Data - 16 KM Station

	Balloon Position			Wind Velocity		
Time	X	Y	Z	U	V	VT
1800.00	.0	.0	.0			
1800.50	14.2	- 2.6	91.4	.47	- .08	.48
1801.00	4.7	- .6	182.8	- .31	.06	.32
1801.50	- 21.2	- 2.5	274.3	- .86	- .06	.86
1802.00	- 47.3	- 4.4	365.7	- .86	- .06	.86
1802.50	- 73.3	- 6.2	457.2	- .86	- .06	.86
1803.00	- 99.3	- 8.1	548.6	- .86	- .06	.86
1803.50	-176.1	7.0	640.0	-2.55	.50	2.60
1804.00	-261.5	14.6	731.5	-2.84	.25	2.85
1804.50	-342.8	31.2	822.9	-2.71	.55	2.76
1805.00	-426.4	57.6	914.4	-2.78	.88	2.92
1805.50	-502.2	90.3	1005.8	-2.52	1.09	2.75
1806.00	-598.6	107.7	1097.2	-3.21	.57	3.26
1806.50	-715.4	117.7	1188.7	-3.89	.33	3.90
1807.00	-831.0	128.6	1280.1	-3.85	.36	3.86
1830.00	.0	.0	.0			
1830.50	78.0	-42.5	91.4	2.60	1.41	2.96
1831.00	116.3	-69.0	182.8	1.27	.88	1.55
1831.50	106.2	-62.5	274.3	- .33	.21	.40
1832.00	53.7	-44.8	365.7	-1.75	.59	1.84
1832.50	1.1	-27.1	457.2	-1.75	.59	1.84
1833.00	- 84.1	-16.9	548.6	-2.84	.34	2.86
1833.50	-169.4	- 6.6	640.0	-2.84	.34	2.86
1834.00	-254.7	3.5	731.5	-2.84	.34	2.86
1834.50	-372.4	43.7	822.9	-3.92	1.34	4.14
1835.00	-490.8	74.2	914.4	-3.94	1.01	4.07
1835.50	-608.2	113.8	1005.8	-3.91	1.31	4.12
1836.00	-716.3	149.6	1097.2	-3.60	1.19	3.79
1836.50	-817.7	170.8	1188.7	-3.38	.70	3.45
1837.00	-941.1	194.9	1280.1	-4.11	.80	4.19
1837.50	-1053.1	218.1	1371.6	-3.73	.77	3.81
1838.00	-1148.3	248.3	1463.0	-3.17	1.00	3.33
1838.50	-1229.9	288.4	1554.4	-2.71	1.33	3.03

Single Theodolite Data - 16 KM Station

	Balloon Position			Wind Velocity		
Time	X	Y	Z	U	V	VT
1900.00	.0	.0	.0			
1900.50	97.5	- 10.2	91.4	3.25	- .34	3.26
1901.00	131.1	- 38.9	182.8	1.12	- .95	1.47
1901.50	164.8	- 67.5	274.3	1.12	- .95	1.47
1902.00	109.2	- 78.5	365.7	-1.85	- .36	1.88
1902.50	49.4	- 107.4	457.2	-1.99	- .96	2.21
1903.00	- 31.8	- 114.2	548.6	-2.71	- .22	2.71
1903.50	- 92.4	- 118.3	640.0	-2.01	- .13	2.02
1904.00	- 181.8	- 112.7	731.5	-2.97	.18	2.98
1904.50	- 280.3	- 73.5	822.9	-3.28	1.30	3.53
1905.00	- 394.7	- 26.9	914.4	-3.81	1.55	4.11
1905.50	- 521.2	10.9	1005.8	-4.21	1.26	4.40
1906.00	- 647.8	37.3	1097.2	-4.21	.88	4.31
1906.50	- 784.3	61.7	1188.7	-4.55	.81	4.62
1907.00	- 921.2	100.0	1280.1	-4.56	1.27	4.73
1907.50	-1054.5	140.7	1371.6	-4.44	1.35	4.64
1908.00	-1179.4	180.5	1463.0	-4.16	1.32	4.37
1908.50	-1310.5	212.2	1554.4	-4.36	1.05	4.49
1909.00	-1456.1	246.2	1645.9	-4.85	1.13	4.98
1909.50	-1520.0	345.3	1737.3	-2.13	3.30	3.93
1910.00	-1457.1	406.8	1828.8	2.09	2.04	2.93
1910.50	-1391.4	484.5	1920.2	2.18	2.59	3.39
1911.00	-1383.2	578.9	2011.6	.27	3.13	3.14
1911.50	-1359.5	634.0	2103.1	.79	1.84	2.00
1912.00	-1363.0	658.9	2194.5	- .11	.83	.83
1912.50	-1399.2	661.4	2286.0	-1.20	.08	1.21
1913.00	-1453.3	677.7	2377.4	-1.80	.54	1.88
1913.50	-1488.3	659.5	2468.8	-1.16	- .60	1.31
1914.00	-1487.9	583.6	2560.3	.01	-2.52	2.52
1914.50	-1491.9	522.4	2651.7	- .13	-2.03	2.04

Single Theodolite Data - 16 KM Station

	Balloon Position			Wind Velocity		
Time	X	Y	Z	U	V	VT
1930.00	.0	.0	.0			
1903.50	24.9	- 44.8	91.4	.83	-1.49	1.71
1931.00	- 2.6	-101.3	182.8	- .92	-1.88	2.09
1931.50	- 61.6	-124.7	274.3	-1.96	- .78	2.11
1932.00	- 121.5	-143.3	365.7	-1.99	- .61	2.09
1932.50	- 187.6	-141.4	457.2	-2.20	.06	2.20
1933.00	- 270.8	-126.8	548.6	-2.77	.48	2.81
1933.50	- 355.5	-100.6	640.0	-2.82	.87	2.95
1934.00	- 444.9	- 78.4	731.5	-2.97	.73	3.06
1934.50	- 557.7	- 41.9	822.9	-3.75	1.21	3.95
1935.00	- 666.7	3.4	914.4	-3.63	1.51	3.93
1935.50	- 789.7	52.4	1005.8	-4.09	1.63	4.41
1936.00	- 921.4	103.3	1097.2	-4.39	1.69	4.70
1936.50	-1060.1	147.1	1188.7	-4.62	1.45	4.84
1937.00	-1185.6	170.8	1280.1	-4.18	.79	4.25
1937.50	-1343.7	191.2	1371.6	-5.26	.67	5.31
1938.00	-1505.1	214.2	1463.0	-5.37	.76	5.43
1938.50	-1673.1	241.1	1554.4	-5.60	.89	5.67
1939.00	-1753.5	290.3	1645.9	-2.67	1.63	3.14
1939.50	-1826.9	365.0	1737.3	-2.44	2.49	3.49
1940.00	-1847.1	446.8	1828.8	- .67	2.72	2.80
1940.50	-1784.2	504.9	1920.2	2.09	1.93	2.85
1941.00	-1731.8	572.7	2011.6	1.74	2.26	2.85
1941.50	-1693.8	670.6	2103.1	1.26	3.26	3.50
1942.00	-1635.0	728.0	2194.5	1.95	1.91	2.73
1942.50	-1623.6	774.4	2286.0	.38	1.54	1.59
1943.00	-1639.6	799.7	2377.4	- .53	.84	.99
1943.50	-1644.7	795.1	2468.8	- .17	- .15	.22
1944.00	-1688.4	812.6	2560.3	-1.45	.58	1.57
1944.50	-1736.7	803.2	2651.7	-1.60	- .31	1.63
1945.00	-1772.0	759.5	2743.2	-1.17	-1.45	1.87